CHAPTER 3. AFFECTED ENVIRONMENT

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3.1 Introduction

This chapter presents the existing environment, including the cultural, physical, biological, social, and economic resources, values, and uses, that would be affected by the Proposed Action and alternatives. The affected area consists of the Alton Coal Tract and the reasonably foreseeable coal haul transportation route, as identified in the Interdisciplinary Team Analysis Record Checklist (Appendix G) and presented in Chapters 1 and 2 of this impact statement. This chapter provides the baseline for comparison of impacts and consequences described in Chapter 4. Management issues identified by the BLM, public scoping, and interdisciplinary analysis of the area have guided the material presented herein.

3.1.1 General Setting

The tract is in Kane County, Utah, approximately 0.10 mile south of the town of Alton and 2.9 miles east of US-89. The tract occurs at approximately 6,900 feet above sea level in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001a) of south-central Utah. The tract is in the Alton Amphitheater between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and approximately 5.0 miles north and northwest of the Grand Staircase-Escalante National Monument. Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same time period was 60.2 degrees Fahrenheit (°F) (2006). The Colorado Plateau province receives most of its precipitation in the form of snow during the winter months; summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006). The tract is characterized by a series of low-rising hills and benches cut by the north-south-running Kanab Creek and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large open areas of bunchgrass, perennial grasses, and sagebrush interspersed with dense stands of juniper and pinyon pine. Tall fir trees are apparent on the more rugged mountains to the northwest of the tract. Generally, the vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines. A map of the tract in relation to surrounding towns, highways, existing and potential fee coal areas, and other area landmarks is presented in Map 1.1.

Under the Proposed Action, the tract includes approximately 3,576 acres of land. All coal resources within the tract are federally (BLM) owned and managed. Approximately 2,280 surface acres of the tract are under BLM management, and the remaining 1,296 surface acres are under private ownership. Under Alternative C and Alternative K1, the tract comprises approximately 3,173 acres and 2,114 acres of land, respectively. As under the Proposed Action, all coal resources under these tract configurations are federally (BLM) owned and managed. Surface ownership under Alternative C and Alternative K1 is split between the BLM (2,280 acres under Alternative C and 1,235 acres under Alternative K1) and private owners (893 acres under Alternative C and 880 acres under Alternative K1). Coal reserves are known to occur beneath approximately 1,750, 1,454, and 869 acres of the tract under the Proposed Action, Alternative C, and Alternative K1, respectively.

The entirety of the reasonably foreseeable coal haul transportation route (hereafter referred to simply as the coal haul transportation route) also occurs in southern Utah, more specifically in Kane, Garfield, and Iron counties near Alton, Hatch, Panguitch, and Cedar City. The total length of the route is approximately 115 miles (see Map 2.5). Existing vehicle traffic consists of local residents; tourists to Bryce Canyon National Park, Dixie National Forest, and BLM-administered lands; and commercial truck traffic. Transportation infrastructure associated with the tract and the reasonably foreseeable coal haul transportation route includes numerous unimproved, dirt roads, KFO Route 116, US-89, SR-20, I-15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is west of Cedar City, Utah, and is the nearest railroad facility to the tract.

3.1.2 Supplemental Authorities and Other Resources, Values, and Uses Brought Forward for Analysis

Decisions related to the tract could affect supplemental authorities as listed in the BLM NEPA Handbook H-1790-1 (2008c) in addition to other resources, values, and uses identified during public and agency scoping. Table 3.1.1 lists the supplemental authorities and other resources, values, and uses brought forward for analysis. Some supplemental authorities and other resources, values, and uses identified during public and agency scoping were not brought forward for detailed analysis. These are also listed in Table 3.1.1, including a brief explanation for their omission from the EIS analysis.

Table 3.1.1. Supplemental Authorities and other Resources, Values, and Uses Considered for the Alton Coal Environmental Impact Statement

Analysis Element (supplemental authority)*	**Brought Forward for Analysis**	**Explanation/ Rationale**
Aesthetic resources (soundscape, visual resources, and nighttime lighting)	Yes	Potentially affected
Air resources (air quality) (42 USC 7401 et seq.)	Yes	Potentially affected
Cultural resources (Native American religious concerns) (16 USC 470; 42 USC 1996)	Yes	Potentially affected
Fire management	Yes	Potentially affected
Geology and minerals	Yes	Potentially affected
Hazardous materials and hazardous and solid waste (43 USC 6901 et seq.; 43 USC 9615)	Yes	Potentially affected
Historic trails	No	Not present
Land use and access	Yes	Potentially affected
Livestock grazing (rangelands)	Yes	Potentially affected
Paleontology	Yes	Potentially affected
Prime and unique farmlands (30 USC 1201 et seq.)	No	Not present
Recreation	Yes	Potentially affected
Socioeconomics (social and economic conditions, public health and safety, EJ) (EO 12898)	Yes	Potentially affected
Soils	Yes	Potentially affected
Transportation	Yes	Potentially affected
Vegetation and special status plant species (invasive and noxious weeds; forests; threatened, endangered, and candidate species; State of Utah and BLM Utah sensitive species)	Yes	Potentially affected
Water Resources (surface-water quality and quantity, groundwater quality and quantity, wetlands/riparian areas, floodplains, AVFs) (EO 11990)	Yes	Potentially affected
Wildlife and special status animal species (threatened, endangered, and candidate species; State of Utah and BLM Utah sensitive species; migratory birds, fish habitat) (50 CFR 600; 67 *Federal Register* 2376, January 17, 2002)	Yes	Potentially affected
Wilderness areas, WSAs, and non-WSAs with wilderness characteristics (43 USC 1701 et seq.; 16 USC 1131 et seq.)	No	Not present
Wild and scenic rivers (16 USC 1271)	No	Not present
Areas of critical environmental concern (43 USC 1701 et seq.)	No	Not present
Native American Trust Resources	No	Not present

* Items (those brought forward for analysis) as listed under the heading "Analysis Element" correspond to section headings in Chapters 3 and 4 of this EIS. These may be the same as the supplemental authorities listed in (BLM 2008c) but not in all cases. Where headings have been changed or combined, the corresponding supplemental authorities and/or the component sections are listed in parentheses. Potential impacts to specially designated areas (such as Bryce Canyon National Park, Cedar Breaks National Monument, and Grand Staircase-Escalante National Monument) are considered under the resource areas of concern for these areas—aesthetic resources, air resources, and recreation.

An analysis area has been identified for each analysis element to analyze potential impacts on the resource. Although analysis areas may differ between resources, the analysis area is generally defined as the outermost boundary of an area that encompasses potential direct and indirect impacts that may result from the No Action Alternative, the Proposed Action, Alternative C, and Alternative K1. The analysis area for each resource brought forward for analysis is defined and described in the sections specifically addressing that resource.

3.1.3 Notes on Data Sources and Tract Acreage

Data and information used to describe the affected environment were gleaned from a variety of sources including internet sources, peer reviewed literature, government agency documents, current and historic permitting documents, and documents reporting the results of studies and data collection efforts completed for the EIS in specific. Key government agency documents from which data and information were extracted include larger scale planning documents, particularly the *Kanab Field Office Proposed Resource Management Plan and Final Environmental Impact Statement* (2008a) and the KFO RMP (BLM 2008b), previous EISs completed for the area (1979, 1980b), and smaller reports published by State of Utah and federal agencies (i.e., reports providing data and descriptions of particular resources). Documents included in the Coal Hollow PAP and reports completed by S. Petersen (ACD 2008; Petersen 2006), E. Petersen (Petersen Hydrologic 2007), and P. Collins (ACD 2008) were also used for applicable data and information given the proximity of this mine to the tract. A variety of data and information was also gathered from a PAP submitted by Utah International Incorporated (UII) to DOGM in July 1987. In this PAP, UII proposed to mine an area including the Alton Coal Tract. Finally, 11 “on the ground” studies have been completed for the affected area (tract and transportation route) in support of analyses specific to this EIS:

1. A traffic study on the reasonably foreseeable coal haul transportation route (Fehr & Peers Transportation Consultants 2013) (Appendix H)
2. A detailed inventory of cultural resources on the tract (Stavish 2008a, 2008c, 2006; Zweifel 2007)
3. A reconnaissance-level vegetation community and habitat type study (Appendix I)
4. A detailed survey for and study of special status vegetation species (see Appendix I)
5. A detailed survey for sandloving penstemon (see Appendix I)
6. A reconnaissance-level potential AVF study (see Appendix F)
7. A reconnaissance-level potential, jurisdictional wetland study (see Appendix I)
8. A detailed jurisdictional wetlands study and preliminary jurisdictional determination (see Appendix I)
9. A night sky darkness impact study (included as Appendix J)
10. An air resources dispersion modeling impact study (see the 2010 and 2014 Marquez Environmental Services documents included in Appendix K)
11. The *Alton Coal Tract LBA EIS Noise Modeling Report* (hereafter the noise modeling report, included as Appendix L)

The NOI published in the *Federal Register* (Volume 71, Number 228, Tuesday, November 28, 2006) noting the BLM’s intent to prepare an EIS for the tract indicates a tract acreage of “3,581.27 acres more or less.” In this analysis, a tract acreage of approximately 3,576 acres is used rather than the approximately 3,581.27 acres listed in the NOI. As explained in Table 1.1.1 and 2.3.1 in Chapters 1 and 2, respectively, the tract acreage was refined and determined for analysis using a variety of sources for boundary data, such as hardcopy maps provided by ACD, the USGS 7.5-minute quadrangle for the area, and a BLM shapefile of coal ownership. As a result of combining these relatively disparate sources of spatial data, and given that data sources are not survey accurate, approximately 5.0 acres of error was detected (hence a tract acreage of 3,576 acres rather than 3,581). Furthermore, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. Finally, some corrections and updates in acreages and other information have been made to develop this SDEIS.

3.2 Aesthetics Resources

Aesthetic resources are elements of the human environment that are perceived and enjoyed by people surrounding the Alton Coal Tract and along the reasonably foreseeable coal haul transportation route. The area of analysis for aesthetic resources possesses aesthetic qualities that are characterized by a visually diverse, rural landscape with few signs of modern development. Aesthetic resources are commonly considered visual resources, or things that are potentially seen with the naked eye. Because of the nature of the Proposed Action, aesthetic resources also include things that can be heard. The existing aesthetic resource conditions described in this SDEIS consist of the soundscape (natural sounds), visual resources (landscape), and the night sky (darkness).

3.2.1 Soundscape

The soundscape of an area is made up of both natural and human-created sounds. The soundscape is the area of analysis affected by changes in sound or vibration levels occurring in the tract. Sound occurs from vibrations radiating through air, water, or solid objects. For the purposes of this section, noise is defined as "unwanted sound" that interferes with normal activities or in some way reduces the quality of the environment. The natural and human-created sounds within a soundscape are characterized as being heard at noise-sensitive human receptors. A noise-sensitive human receptor is a place where sounds can be heard and may consist of residences, hospitals, libraries, recreation areas, churches, and similar locations. Exposure to prolonged, high levels of noise can result in temporary or permanent hearing loss or tinnitus (a ringing or roaring in the ears), and can also present safety issues. Although noise is known to have an effect on wildlife health and behavior, this section primarily considers sound and noise levels as they relate to the human environment. See Sections 4.17 and 4.18 for more information on how mine-related noise would affect wildlife and special status species on and near the tract.

3.2.1.1 SOUNDSCAPE ANALYSIS AREA

The soundscape analysis area consists of the towns of Alton, Panguitch, and Hatch; BLM-managed lands adjacent to the tract; Bryce Canyon National Park (Yovimpa Point, Farview Point, and Riggs Springs); the reasonably foreseeable coal haul route; and the reasonably foreseeable coal haul rail loadout location at the terminus of the reasonably foreseeable coal haul route and nearby residential area.

3.2.1.2 SOUND LEVEL CHARACTERISTICS

Humans experience sound based on frequency and amplitude. Frequency is defined as the number of pressure variations per second in the air. It is expressed in hertz (Hz). Humans can generally hear sound in the 20- to 20,000-Hz range. Amplitude is the magnitude of a sound and is usually expressed in dB, a dimensionless ratio of sound pressure to that of a reference pressure (usually 20 micropascals). The threshold of human hearing is 0 dB. Decibels are measured on a logarithmic scale. A change in sound level of 10 dB is perceived by the average person as doubling (or halving) the level of loudness. Because the human ear perceives sounds differently at low frequencies than at high frequencies, measured sound levels may be adjusted to correspond to human hearing. The A-weighted dB (dBA) is the adjusted unit of sound used to describe the human response to noise from industrial and transportation sources, including mining activities. Sound levels and characteristic impressions of common noise sources and environments are presented in Table 3.2.1.

Table 3.2.1. Common Sound Levels

Noise Source	Sound Level* (dBA)	Characteristic Impression	Relative Loudness[†]
Jet takeoff (50 feet)	140	Threshold of pain	64 times as loud
Rock concert near stage, jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy diesel truck or motorcycle (25 feet)	90	–	2 times as loud
Garbage disposal (2 feet)	80	Moderately loud	Reference loudness
Vacuum cleaner (10 feet)	70	–	1/2 as loud
Light auto traffic (25 feet)	50	Quiet	1/8th as loud
Living room, bird calls	40	–	1/16th as loud
Library	30	Very quiet	–
Acoustic test chamber	10	–	–

Source: EPA (1974).
* For comparison purposes, the threshold of hearing is 0 (zero) dB.
[†] Relative loudness is the human judgment of different sound levels.

Although dBA indicates the level of noise at a single specific point in time, noise levels within a soundscape vary continuously and include sounds from a variety of sources. This variation can be accounted for using the equivalent continuous sound level (L_{eq}). The A-weighted L_{eq} therefore is the dBA average over some time interval. Because of the greater sensitivity to noise levels at night, 10 dBA are often added to any nighttime sounds before calculating an average using the day-night average sound level (L_{dn}). Natural ambient sound levels (L_{nat}) are derived by subtracting out all human-caused, mechanical, or electrical sounds from collected sound level data. Noise data gathered by the NPS are presented in both L_{eq} and L_{nat}.

3.2.1.3 FEDERAL REGULATORY NOISE STANDARDS

The following identifies federal laws and regulations that are pertinent to the evaluation of the mine-related activities and analysis of soundscape impacts. There is no state or local noise control program in the analysis area; therefore, federal standards and regulations would apply. Where two or more federal regulatory standards or guidelines overlap, the standard or guideline with the most stringent criteria would take precedence.

Numerous laws and guidelines at the federal level are relevant to the assessment of noise and vibration impacts. These include the following:

- Noise Control Act of 1972, as amended (Public Law [PL] 92-574, 42 USC 4901 et seq.)
- U.S. Department of Transportation Federal Highway Administration (FHWA) guidelines that specifically address traffic noise (23 CFR 772)
- U.S. Department of Housing and Urban Development (HUD) guidelines (24 CFR 51.101)
- MSHA occupational noise exposure health standards (30 CFR 62.130)
- MSHA surface-mining activity performance standards regulating the use of explosives (24 CFR 816.61 to 816.68)
- Occupational Safety and Health Administration (OSHA) Occupational Noise Exposure; Hearing Conservation Amendment (*Federal Register* 48[46]:9738–9785)

Each of these federal laws and regulations and their applicability to the mine-related activities are discussed in further detail below.

3.2.1.3.1 U.S. Environmental Protection Agency, Noise Control Act of 1972

The federal Noise Control Act of 1972 recognizes that uncontrolled noise can impact the health and welfare of the nation's population. The act further declares that it is United States' policy to promote an environment free from noise that jeopardizes the health or welfare of the nation's population (EPA 1974). In 1974, the EPA released a document identifying a 24-hour exposure level of 70 L_{dn} (day-night sound level) as the level of environmental noise to prevent measurable hearing loss over a lifetime (EPA 1974). The same document identifies L_{dn} levels of 55 dBA outdoors and 45 dBA indoors to prevent annoyance. Therefore, mine activity noise levels of 55 dB L_{dn} or above outdoors for residential land use and 45 dBA L_{dn} or above indoors for residential land use would be considered above the regulatory threshold.

3.2.1.3.2 U.S. Department of Transportation, Federal Highway Administration

The FHWA has issued regulations for noise evaluation in 23 CFR 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. The main objectives of 23 CFR 772 are "to provide procedures for noise studies and noise abatement measures, to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to Title 23, United States Code." According to FHWA regulations, a traffic noise impact occurs when the predicted traffic noise level approaches or exceeds the noise abatement criteria for the specified land use. In addition, an impact occurs when the predicted traffic noise level substantially exceeds the existing noise level.

Noise level impact criteria may be based on a threshold, the change in noise level from the existing noise level, or both. Table 3.2.2 shows the FHWA-defined noise abatement criteria for various land use categories. Noise levels in excess of any of the applicable-use FHWA noise thresholds from traffic increases associated with mine activities would be above the regulatory threshold.

Table 3.2.2. Noise Abatement Criteria

Land Use Category	Noise Level L_{Aeq1h}* (dBA)	Description of Land Use
A	57 (exterior)	Land on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks, or open spaces that are recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67 (exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, playgrounds, active sports areas, and parks.
C	72 (exterior)	Developed lands, properties, or activities not included in Categories A and B above.
D	–	Undeveloped lands.
E	52 (interior)†	Residences, motels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: 23 CFR 772.

Note: FHWA-defined land use categories and noise abatement criteria (23 CFR 772).

* L_{Aeq1h} is the one-hour equivalent sound level.

† The interior sound level (activity) applies to 1) indoor activities for those parcels where an exterior noise-sensitive activity is identified, and 2) those situations where the exterior activities will not be affected by the noise, but the interior activities will be affected.

3.2.1.3.3 U.S. Department of Housing and Urban Development

A goal in the *Noise Guidebook* (HUD 1985) is that outdoor residential areas follow the EPA guideline of 55 dBA L_{dn} (24 CFR 51.101(a)(8)). This guideline is outlined in the 1974 EPA report discussed in the EPA Noise Control Act discussion above (EPA 1974). However, for the purposes of meeting HUD regulations, sites with an L_{dn} of 65 dBA and below are acceptable and allowed. Although the EPA has set 55 dBA L_{dn} as the basic goal, other federal agencies (including HUD), in consideration of their own program requirements and goals as well as the difficulty of achieving a goal of 55 dBA L_{dn}, have settled on the 65-dBA L_{dn} level as their standard.

At 65 dBA L_{dn}, HUD has determined that activity interference is kept to a minimum and annoyance levels are still low. It is also a level that can realistically be achieved. Following the federal lead, most local jurisdictions that have adopted noise standards have adopted 65 dBA L_{dn} as the breakpoint for acceptability. Table 3.2.3 summarizes the HUD acceptability standards. Mine activity–related noise of 65 dBA L_{dn} or greater for residential areas would be in excess of the HUD noise standards.

Table 3.2.3. U.S. Department of Housing and Urban Development Site Acceptability Standards

Rating	Day-night Average Noise Level (dBA)	Special Approvals and Requirements
Acceptable	Not exceeding 65*	None
Normally unacceptable	Above 65 dBA but not exceeding 75	Special approvals,† environmental review,† attenuation‡
Unacceptable	Above 75	Special approvals,‡ environmental review,‡ attenuation

* Acceptable threshold may be shifted to 70 dBA in special circumstances pursuant to 24 CFR 51.105(a).

† See 24 CFR 51.104(b) for requirements.

‡ 5 dBA additional attenuation required for sites above 65 dBA but not exceeding 70 dBA, and 10 dBA additional attenuation required for sites above 70 dBA but not exceeding 75 dBA (24 CFR 51.104[a]).

3.2.1.3.4 U.S. Occupational Safety and Health Administration, Occupational Health and Safety Act

The Occupational Health and Safety Act of 1970 established hearing conservation noise exposure regulations for workers (29 CFR 1910). The purpose of the act is to assure safe and healthful working conditions. Worksite noise levels are regulated by 29 CFR 1910.95, which deals with occupational noise exposure. This section limits the noise pressure level to 90 dBA continuous exposure for an eight-hour day. If workers are exposed to an eight-hour time-weighted average of 85 dBA or greater, then a worker hearing protection program that includes baseline and periodic hearing testing, availability of hearing protection devices, and training in hearing damage prevention is required.

3.2.1.3.5 U.S. Department of Labor, Mine Safety and Health Administration

Hearing loss has been a health risk faced by many mine workers. In 1999, MSHA published new health standards for occupational noise exposure. These standards apply to all surface and underground metal, nonmetal, and coal mines. The purpose of these mandatory standards is to prevent occupational, noise-induced hearing loss among miners. The standards establish several circumstances where mine operators must take action (30 CFR 62.130). They are as follows:

- If miners are exposed to 85 dBA or more over an eight-hour period, they are required to enroll in a hearing protection program.

- If miners are exposed to 90 dBA or more over an eight-hour period, they must use feasible engineering and administrative controls to reduce noise levels.
- If miners are exposed to 105 dBA or more over an eight-hour period, they must ensure that they use both ear plug and earmuff-type hearing protectors.
- Miners must not be exposed to sound levels exceeding 115 dBA at any time.

Additionally, MSHA regulations governing the use of explosives for mines specify maximum limits for blasting noise and vibration at "any dwelling, public building, school, church, or community or institutional building" according to the levels presented in Tables 3.2.4 and 3.2.5 (30 CFR 816.67(b)(i)). Exceedances of blasting regulations for noise or vibration from mine blasting would be considered above the regulatory threshold.

Table 3.2.4. Federal Airblast Noise Limits

Lower Frequency Limit of Measuring System (Hz [+ / - 3 dB])	Maximum Level (dB linear)
0.1 Hz or lower (flat response)	134 peak
2 Hz or lower (flat response)	133 peak
6 Hz or lower (flat response)	129 peak
C-weighted (slow response)	105 peak dBC*

Source: Adapted from table in 30 CFR 816.67(b).

* The "C" in dBC refers to C-weighted sound levels (instead of A-weighted or linear; C indicates no weighting).

Table 3.2.5. Federal Blasting Vibration Limits

Distance from the Blasting Site (feet)	Maximum Allowable Peak Particle Velocity for Ground Vibration (inches per second)
0–300	1.25
301–5,000	1.00
5,001 and beyond	0.75

Source: Adapted from table in 30 CFR 816.67(d)(2).

3.2.1.3.6 Additional Thresholds

Additionally, airblast and vibration adverse impacts and awareness/annoyance thresholds are presented in *Alton Coal Tract LBA EIS Noise Modeling Report* (see Appendix L). Mine-related blasting noise and vibration emissions will be compared against the airblast and vibration thresholds presented in Table 3.2.6.

Table 3.2.6. Airblast and Vibration Blasting Threshold Values

Airblast Threshold	Sound Pressure Level (dB linear)	Source
Lowest threshold for building damage and human disturbance	134	30 CFR 816.67(b)
Barely noticeable threshold for humans	100	Richards and Moore (2009)
Vibration Threshold	**Peak Particle Velocity (inches per second)**	**Source**
Lowest threshold for building damage	0.500	Chae (1978); Siskind et al. (1980)
Lowest threshold for human awareness (outdoors)	0.035	Wiss and Nichols (1974)
Lowest threshold for human awareness (indoors)	0.004	Jones & Stokes (2004)

3.2.1.4 AMBIENT AND EXISTING NOISE LEVELS IN THE ANALYSIS AREA

On September 15 and 16, 2008, existing, outdoor sound levels were measured at seven points in and near the town of Alton: three points in Alton, one point in Hatch, and three points in Panguitch. Measurements were recorded for each location on environmental noise data sheets (SWCA 2008). Locations were selected to be representative of sensitive noise receptors and existing noise levels within the area of analysis. The elements of sound along the entire reasonably foreseeable coal haul transportation route, from the tract to the Iron Springs loadout, vary from day to night, and vary across seasons. Typical noise sources include motorized vehicle traffic, ranch machinery, aircraft traffic overhead, and wind.

In the town of Alton, sound levels were measured at three separate locations adjacent to surface streets in the town (Map 3.1). Five-minute to 15-minute measurements were used to determine an average. Average daytime levels ranged from 41 dBA L_{eq} at the south end of Alton to 55 dBA L_{eq} within the town at the corner of 100 West and 100 North.

In the town of Hatch, the sound level was measured at one location, 50 feet from the centerline of US-89, on the northeast side of a church (see Map 3.1). The average daytime level was recorded at 64 dBA L_{eq} over a period of 15 minutes.

In the town of Panguitch, the sound level was measured at three separate locations (see Map 3.1). The first was 40 feet from the centerline of Main Street. The sound level at this site was recorded for 24 hours from a sound meter placed 10 feet above ground level on a utility pole. The 24-hour average was 67 dBA L_{eq}. The two remaining measurements were taken for 15 minutes from locations adjacent to surface streets within the town. Average daytime levels at both locations were 64 dBA L_{eq}.

Background levels presented in the noise analysis use data from Bryce Canyon National Park noise level surveys were gathered by NPS personnel from 2009 to 2012 for three areas in the park (Farview F, Yovimpa F, and Riggs Spring B ("F" represents "Front-country" and "B" represents "Back-country"; Map 3.2). Modeled tract noise was compared to the most conservative background values from these three areas analyzed in Bryce Canyon:

- 31.8 dBA L_{nat} (53.0 dBA L_{eq}) for Farview F
- 27.1 dBA L_{nat} (42.0 dBA L_{eq}) for Yovimpa F
- 24.5 dBA L_{nat} (40.0 dBA L_{eq}) for Riggs Spring B

No data were gathered for ambient sound levels surrounding the reasonably foreseeable rail loadout location near Cedar City. Therefore, for conservatism, baseline conditions at this site were assumed to be those of the lowest recorded value for Bryce Canyon (40.0 dBA L_{eq} at Riggs Spring B).

3.2.1.5 MODELING AND NOISE RECEPTOR SITE LOCATIONS IN THE SOUNDSCAPE ANALYSIS AREA

Receptors in Bryce Canyon National Park are 13.5 or more miles (21.7 kilometers [km]) away from the tract. The reasonably foreseeable rail loadout location is approximately 50 miles (80.5 km) from the tract, and receptors in a small community 4.5 miles (7.2 km) northeast of the loadout location are approximately 45 miles from the tract. Receptors on Dixie National Forest are 1.0–4.0 miles (1.6–6.4 km) away from the tract. Residents of Alton and nearby ranches are within 0.1 mile (0.2 km) of the tract (the northwest portion of the tract, or Block NW) and within 2.0 miles (3.2 km) of the proposed location of the centralized facilities. In addition, noise was modeled along portions of the reasonably foreseeable coal haul transportation route where sensitive receptors could be impacted (i.e., within the town boundaries of Alton, Hatch, and Panguitch). This transportation route included local roadways in the town of Alton from the mining tract boundary to Alton Road, from Alton Road to US-89, and approximately 3.7 miles (6.0 km) of US-89 running north from the intersection of Alton Road and US-89. Modeling for the town of Panguitch, approximately 37 miles from the tract, took into account approximately 4.6 miles (7.4 km) of US-89, including the portion of US-89 that runs through the town. Modeling for the town of Hatch, approximately 22 miles from the tract, modeled approximately 3.8 miles (6.2 km) of US-89 (including the portion running through town). Sensitive receptors (residences, schools, churches, etc.) occur in various locations within 40 feet of the reasonably foreseeable coal haul transportation route within these towns. See Map 3.2 for the receptor locations.

Because noise and vibration from blasting activities can extend several miles or more, and because noise from heavy machinery and coal haul trucks would extend a few hundred feet or less, the analysis area varies under different aspects of mining operations. Noise emissions from mobile and stationary sources were modeled out to a distance of approximately 3.1 miles (5.0 km) from the proposed mining blocks. The roadway noise emissions were modeled out to a distance of approximately 0.6 mile (1.0 km) from the existing roadways. Blasting noise and vibration were evaluated at specific points of concern (i.e., points within Bryce Canyon National Park and the town of Alton). The maximum extent out to which vibration and noise regulatory thresholds and lowest identified thresholds of human annoyance/awareness could be exceeded from blasting events was also calculated.

3.2.1.6 SOUNDSCAPE MANAGEMENT OBJECTIVES

The BLM has no management prescriptions for the reduction of noise or protection of soundscapes (BLM 2008a). NPS management policies and objectives direct parks to provide for natural quiet and solitude as outlined in various planning documents and Director's Order #47 (Soundscape Preservation and Noise Management, signed on December 1, 2000). Bryce Canyon National Park in particular is recognized for the importance of the natural quiet that the park offers. Maintaining natural soundscapes is a management objective for Bryce Canyon National Park (NPS 1983, 1987). At Bryce Canyon National Park, the soundscape has been studied for over 10 years, with intensive monitoring over the last three summers (2009–2011) at locations throughout the park, including Yovimpa Point. The baseline conditions for the park are well documented and were used to assist the BLM in their soundscape analysis.

3.2.2 Visual Resources

Visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of waters (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). These elements of the landscape can be described in terms of their form, line, color, and texture. Normally, the more variety of elements in a landscape, the more interesting or scenic the landscape becomes, if the elements exist in harmony with each other. The BLM manages landscapes for varying levels of protection and modification, giving consideration to other resources values and uses and the scenic quality of the landscape.

3.2.2.1 VISUAL RESOURCES ANALYSIS AREA

The visual resources analysis area consists of lands where potential alteration of the landscape from the proposed tract may be discerned. It consists of areas in and adjacent to the tract, the Grand View and Paunsaugunt trails on the Dixie National Forest, and the town of Alton (Map 3.3). The tract is not visible from viewpoints within Bryce Canyon National Park (there is no direct line of sight); however, Bryce Canyon is considered part of the analysis area and a viewshed (line of sight) analysis is included in Chapter 4. Additionally, because no landscape change along the reasonably foreseeable coal haul transportation route is proposed, it is not considered part of the visual analysis area.

3.2.2.2 CHARACTERISTIC LANDSCAPE

The tract lies in the Alton Amphitheater south of the town of Alton in Kane County, Utah, between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and the Gray Cliffs of the west edge of the Grand Staircase-Escalante National Monument to the south. The tract is characterized by a series of low-rising hills and benches cut by the north-south-running Kanab Creek, and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large, open areas of bunchgrass; perennial grass, forbs, and shrubs; and gray-green sagebrush interspersed with dense stands of darker green juniper and pinyon pine (see Section 4.15 for a full description of vegetation resources in the tract). Tall fir trees are apparent on the more rugged mountains to the northwest. Vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines.

The landscape of the tract has been partially modified by human development and activities. Dirt roads, dispersed ranches, agricultural fields, barbed wire fence lines, and large blocks of vegetation treatments have resulted in changes to the landscape of the tract. The graded dirt road (KFO Route 116) is a reddish tan band that traverses north–south along the length of the tract. Several ranches and homes surrounded by large cottonwood trees are east of KFO Route 116 outside the southeast edge of the tract. Green fields and meadows occur south of Alton and in the low-lying areas between the tract and the foothills of the Paunsaugunt Plateau. Barbed wire fences lined with tall, decadent sagebrush and rabbitbrush dissect the tract in various directions. Approximately 750 acres, or 21% of the tract, have undergone mechanical vegetation treatments. Large, geometric vegetation treatment areas where trees and shrubs have been mechanically knocked over occur throughout the tract, leaving down, grayish white trunks and limbs interspersed with minimal grasses and shrubs. The geometric lines of the agricultural fields and vegetation treatments are large, and they are not readily apparent from locations within the tract. However, they are visible from the elevated viewpoints along the Dixie National Forest trails on the Paunsaugunt Plateau.

Although the tract has been modified by the activities described above, the setting is natural and remains largely undeveloped with few visible buildings and structures. Tree-covered mountains and white-, tan-, and red-colored cliffs border the tract to the north and east. In the background, east of the tract, the bright, colorful, and jagged cliffs of the Paunsaugunt Plateau on the Dixie National Forest increase the sense of a natural and undeveloped landscape.

3.2.2.3 VISUAL RESOURCES INVENTORY AND VISUAL RESOURCE MANAGEMENT OBJECTIVES

Through the land use planning process, BLM sets objectives for the management of landscape preservation and change. All lands are placed into one of four classes that identify the degree of acceptable landscape change or alteration, giving consideration to the scenic value of the landscape and other resource values and uses of the land. Class I objectives are established in areas where no landscape change is desired. Class IV objectives are set for landscapes where the BLM manages for uses that will result in substantial landscape changes (e.g., mining, energy development, wind farms). Classes II and III allow for varying degrees of landscape preservation and change in between Classes I and IV.

The visual resource management (VRM) class objectives for the tract were established in the KFO RMP (BLM 2008b). Lands in the tract have been allocated to VRM Class IV management objectives (Map 3.4). The 1,296 acres of private land in the tract is not managed under any VRM class objectives. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be the major focus of viewer attention.

3.2.3 Nighttime Lighting and the Extent of Skyglow

A natural lightscape is defined by the NPS Air Resources Division as “a place or environment characterized by the natural rhythm of sun and moon cycles, clean air, and of dark nights that are unperturbed by artificial lights” (NPS 2008d). Dark night skies are a part of the everyday experience of residents of Alton as well as part of the experience and expectation of visitors seeking recreation opportunities at NPS-managed lands. Bryce Canyon National Park has long been considered a leader in the protection and interpretation of dark skies. Park management also emphasizes the preservation of dark skies and astronomy through an extensive interpretive program, hosting dozens of astronomy educational programs throughout the year, including an annual astronomy festival held in late June.

3.2.3.1 SKYGLOW ANALYSIS AREA

The area of analysis for skyglow includes the tract’s surrounding lands that could be affected by changes in artificial lighting occurring from the Proposed Action and alternatives. Because lighting can disperse through the atmosphere and may extend further than 12 miles, the analysis area consists of the town of Alton, Dixie National Forest, Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Because mine-related traffic would occur along existing roads associated with the reasonably foreseeable coal haul transportation route and would be intermittent and in motion, no attempt was made to model lighting produced, and the coal haul transportation route is not considered in the area of analysis for skyglow.

3.2.3.2 EXISTING DARK SKY CONDITIONS

There are several methods available for measuring skyglow and for measuring the brightness of night skies. Amateur[1] astronomers use limiting magnitude to measure the brightness of the night sky. Limiting magnitude describes the faintest stars that can be seen with the unaided eye. Amateur astronomers

[1] Use of the term *amateur* is intended to distinguish between the types of astronomical observations made at Bryce Canyon (observations made with the human eye and/or telescope in a uniquely dark sky environment) and professional astronomical observations made at observatories using high technology equipment with varying background lighting conditions (the Whipple Observatory, for example, is situated near Tucson, a considerable source of light pollution). The relative sensitivity of dark-adapted human vision and to broad-spectrum sources is a factor of critical importance in the much-darker environment of southern Utah and for the types of visual uses at Bryce Canyon. The nature of night use and observations at Bryce Canyon is much different than professional astronomical observation, and is based heavily on visual appearance of the entire sky and landscape rather than the sensitivity of astronomical instrumentation to skyglow at angles considerably above the horizon (where most astronomical observation occurs).

compare the night sky to a star chart with known magnitudes. Limiting magnitude is then determined by the faintest star from the chart that is visible to the naked eye. Site-specific data on the darkness of the night skies over the tract were not available; therefore, the brightness of the night sky is based on the known limiting magnitude and night sky observations from Bryce Canyon National Park and Cedar Breaks National Monument. The night skies from viewpoints in Bryce Canyon National Park (e.g., Rainbow and Yovimpa points) have a limiting magnitude rating of 7.4. They are judged by NPS employees to be as dark as world class astronomical research locations (NPS 2008b). These dark night skies are the result of good air quality, low humidity, high elevation, and minimal sources of light pollution and skyglow.

Night sky conditions have been recorded by the NPS from both Yovimpa Point in Bryce Canyon National Park and from Brian Head Peak near Cedar Breaks National Monument (Moore 2008). Night sky conditions are also recorded from both the east entrance and Lava Point within Zion National Park. Due to its proximity to St. George, Utah and Las Vegas, Nevada, night skies are brighter at Zion National Park than at Bryce Canyon National Park and Cedar Breaks National Monument. However, most of the visitation experience in Zion National Park occurs at lower elevations and within steep-walled canyons, minimizing the amount of potential light pollution that reaches visitors.

Yovimpa Point is near the south end of Bryce Canyon National Park and is approximately 13 miles from the tract. From Yovimpa Point, there are apparent increases in night sky brightness resulting from natural air glow and from artificial light sources from 11 towns and cities surrounding the park, including Alton, Utah as well as Fredonia and Page, Arizona. In the area of sky opposite the tract, there is no apparent increase in skyglow from artificial light sources observed from Yovimpa Point. The greatest source of skyglow observed from Yovimpa Point comes from Cedar City, Utah, approximately 48 miles the northwest of the tract (included as Appendix J).

Brian Head Peak is approximately 1.0 mile north of Cedar Breaks National Monument and 26.5 miles northwest of the tract. It has greater night sky brightness than that visible from Yovimpa Point. The night sky brightness comes primarily from the artificial light sources of Cedar City and St. George, Utah. The zenith of the night sky above Brian Head Peak appears approximately 6% brighter than under natural conditions, with brightness increasing closer to the horizon toward Cedar City and St. George. In addition, there are up to seven other cities and towns generating visible light domes surrounding Brian Head Peak (included as Appendix J).

Amateur astronomers can qualitatively rank the brightness of the night sky using the Bortle Dark-Sky Scale, a numeric nine-level measure of the night sky brightness of a specific location (Table 3.2.7) (Bortle 2001). Under optimal conditions, Bryce Canyon National Park is assumed to have a Bortle Dark-Sky rating Class 3, equaling that of a rural sky. Because there are few sources of artificial light between the park and the tract, it is further assumed that the tract is a Bortle Dark-Sky rating Class 3.

Table 3.2.7. Bortle Dark-Sky Scale

Class	Title	Naked Eye Limiting Magnitude	Description
1	Excellent dark sky site	7.6–8.0	Zodiacal light, gegenschein, zodiacal band visible; M33 direct vision naked-eye object; Scorpius and Sagittarius regions of the Milky Way cast obvious shadows on the ground; airglow is readily visible; Jupiter and Venus affect dark adaptation; surroundings basically invisible.
2	Typical truly dark site	7.1–7.5	Airglow weakly visible near horizon; M33 easily seen with naked eye; highly structured summer Milky Way; distinctly yellowish zodiacal light bright enough to cast shadows at dusk and dawn; clouds only visible as dark holes; surroundings still only barely visible silhouetted against the sky; many Messier globular clusters still distinct naked-eye objects.
3	Rural sky	6.6–7.0	Some light pollution evident at the horizon; clouds illuminated near horizon, dark overhead; Milky Way still appears complex; M15, M4, M5, M22 distinct naked-eye objects; M33 easily visible with averted vision; zodiacal light striking in spring and autumn, color still visible; nearer surroundings vaguely visible.
4	Rural/ suburban transition	6.1–6.5	Light pollution domes visible in various directions over the horizon; zodiacal light is still visible, but not even halfway extending to the zenith at dusk or dawn; Milky Way above the horizon still impressive, but lacks most of the finer details; M33 a difficult averted vision object, only visible when higher than 55°; clouds illuminated in the directions of the light sources, but still dark overhead; surroundings clearly visible, even at a distance.
5	Suburban sky	5.6–6.0	Only hints of zodiacal light are seen on the best nights in autumn and spring; Milky Way is very weak or invisible near the horizon and looks washed out overhead; light sources visible in most, if not all, directions; clouds are noticeably brighter than the sky.
6	Bright suburban sky	5.1–5.5	Zodiacal light is invisible; Milky Way only visible near the zenith; sky within 35° from the horizon glows grayish white; clouds anywhere in the sky appear fairly bright; surroundings easily visible; M33 is impossible to see without at least binoculars; M31 is modestly apparent to the unaided eye.
7	Suburban/ urban transition	5.0 at best	Entire sky has a grayish white hue; strong light sources evident in all directions; Milky Way invisible; M31 and M44 may be glimpsed with the naked eye, but are very indistinct; clouds are brightly lit; even in moderate-sized telescopes the brightest Messier objects are only ghosts of their true selves.
8	City sky	4.5 at best	Sky glows white or orange (you can easily read without additional lighting); M31 and M44 are barely glimpsed by an experienced observer on good nights; even with telescope, only bright Messier objects can be detected; stars forming familiar constellation patterns may be weak or completely invisible.
9	Inner city sky	4.0 at best	Sky is brilliantly lit with many stars forming constellations invisible and many weaker constellations invisible; aside from Pleiades, no Messier object is visible to the naked eye; only objects to provide fairly pleasant views are the Moon, the Planets, and a few of the brightest star clusters.

Source: Adapted from Bortle 2001.

Light pollution is defined as the illumination of the night sky caused by artificial light sources (Bortle 2001). Effects of light pollution consist of a decrease in the visibility of stars and other natural night sky features, as well as disruption to natural lightscapes. Light pollution is caused by artificial light sources that are directed upward or sideways. Light then scatters throughout the atmosphere resulting in skyglow. Other factors that influence skyglow consist of humidity, snow cover, cloud cover, and increased PM in the air. Another form of light pollution is the glare that results from direct lighting.

Artificial light sources in the area of analysis include residential, commercial, and some street lighting from the towns of Tropic, Hatch, and Alton, as well as campgrounds and other developed facilities within Bryce Canyon National Park and Dixie National Forest. Because there are so few sources of light pollution, the night skies in the area of analysis are some of the darkest skies in the continental United States (NPS 2008b).

Dark Sky Partners provided a calculation of the predicted average sky luminance (ASL), both for total skyglow and artificial skyglow only, in the updated technical report presented in Appendix J. The ASL is a measure of luminance of the sky as seen from the observer's location, and it is useful in describing the quality of the entire hemisphere of the sky instead of just a particular segment of the sky. Luminance is the brightness per unit area of the sky (typically measured in nanoLamberts [nL], or mag/arcsec^2).

Background ASL values were measured by NPS staff at Bryce Canyon National Park on two occasions. On November 17, 2004, NPS staff measured a value of 101 nL from Yovimpa Point and estimated that 95 nL could be attributed to natural skyglow (6 nL to artificial skyglow). Again on March 14, 2007, NPS staff measured a value of 67 nL from Yovimpa Point and estimated that 59 nL could be attributed to natural skyglow and 8 nL to artificial. The November 17 results are for a relatively bright natural sky, whereas the March 14 results are for a night with an unusually faint natural skyglow. The NPS measurements include trees near the horizon that block part of the sky; therefore, the artificial contribution may be underestimated. The uncertainties in these measurements are approximately 5%. The natural sky condition chosen for modeling of 72.71 nL by Dark Sky Partners is reasonable and within the values measured by the NPS of 67 nL and 101 nL. Additionally, the quantity of artificial light (9.09 nL) used to initialize the model is reasonable given the measured values of 6 nL and 8 nL.

3.2.3.3 LIGHTSCAPE MANAGEMENT OBJECTIVES

The BLM does not set management objectives for night skies and lightscapes through the land use planning process. The NPS will preserve, to the greatest extent possible, the natural lightscapes of parks. The NPS also works with park visitors, neighbors, and other agencies to prevent and minimize the intrusion of artificial lights on the night skies of national parks (NPS 2008d). Natural skyglow does occur, and can result from such things as moonlight, the Milky Way, low clouds, and airglow. Airglow is the emission of light from the Earth's upper atmosphere. NPS's policy is to consider the best 20% of night sky conditions, as recorded during night sky monitoring, when evaluating action alternatives.

3.3 Air Resources

The air quality of a given airshed or region is determined by the topography, meteorology, location of air pollutant sources, and type, quantity, and combination of air pollutants. The calculated or measured concentrations of various pollutants are compared to established standards to evaluate the impact of a given source on regional air quality.

The air resources analysis area consists of an approximately 150-km area surrounding the Alton Coal Tract (Map 3.5). The following sections address the local weather and climate, the air quality regulatory requirements, and the existing air quality of the air resources analysis area (i.e., the near-field and far-field modeling domains as depicted in Map 3.5).

3.3.1 Climate and Weather

Utah's weather and climate are governed by altitude, latitude, and major mountain chains. These three characteristics also affect the dispersion potential of air emissions. In general, the main chain of the Rocky Mountains provides a barrier from cold Arctic weather, whereas the Sierra Nevada and Cascade Mountains often prevent low-level, Pacific-storm moisture from reaching Utah. The proximity of the tract to the Wasatch Range and Plateau strongly influences its weather. The prevailing winds of the Pahvant Range and the Tushar and Brian Head mountains are westerly, and storms moving into Utah from the west encounter the south-central mountains. This mountainous terrain causes the air to rise and cool (orographic lifting), which squeezes out moisture that would otherwise pass over the area. These mountain chains also act as barriers to air mass flow and are responsible for the aridity of areas east of the mountains, which are characterized by hot, dry summers and cold, dry winters.

Synoptic (large scale) flow dominates the airflow on the mesa all along the Wasatch Plateau. In the absence of strong prevailing winds, wind movement within the valleys, canyons, and gulches is extremely complex. The terrain features suggest that there is a daily exchange of downslope and upslope flows oriented along the valley axis, which is controlled by surface heating and cooling. Downslopes (i.e., drainage flows) last longer and occur during the evening, night, and early morning hours, whereas upslope flows occur mid-day, when temperatures are at their high. Significant diurnal drainage flows can be expected along the south-central mountains. Drainage flows (slope and valley winds) commonly occur with local topographical features and may be accompanied by temperature inversions.

Daily and annual air temperatures differ considerably throughout the area and can vary greatly depending on elevation, as evidenced by monitoring data from the Western Regional Climate Center (WRCC) and from the National Oceanic and Atmospheric Administration (NOAA). Temperature recorded near the tract has annual, mean daily highs and lows ranging from 60.0°F to 31.1°F, respectively. July is the hottest month, with mean daily highs and lows ranging from 82.2°F to 50.0°F, respectively (WRCC 2010). At a higher elevation nearby, the recorded annual, mean daily temperature at Bryce Canyon National Park is 40.6°F and the annual normal highs and lows range from 54.6°F to 26.6°F. July is the hottest month with a mean daily temperature of 62.5°F, with mean daily highs and lows ranging from 78.3°F to 46.6°F (NOAA 2004).

Average annual precipitation in the area is 16.6 inches (WRCC 2010). This value compares well with the Bryce Canyon National Park data, which show average annual precipitation of 16.4 inches (NOAA 2004).

Complete weather data at the tract are not available. Based on direction from the UDAQ, data recorded at the Cedar City Station at the airport in Cedar City, Utah, approximately 43 miles northwest of the tract, are considered representative of the tract's location (UDAQ 2008). These data comprise the only complete weather dataset available for air dispersion modeling near the tract and the reasonably foreseeable coal haul transportation route. Although a meteorological station is near the Coal Hollow

Mine, its placement is 2 meters above ground rather than 10 meters—the required height for data to be used for modeling. In addition, only wind speed and wind direction data are collected at this station; estimation of hourly stability class for modeling would require using the data from Cedar City. Therefore, the data collected at the Coal Hollow Mine are not adequate for use in a dispersion model. Cedar City is warmer than Alton and has an annual, mean daily temperature of 50.5°F, with annual, normal highs and lows ranging from 64.4°F to 36.5°F. July is the hottest month with a mean daily temperature of 73.6°F, with mean daily highs and lows ranging from 89.4°F to 57.8°F (NOAA 2004).

Wind data collected from Cedar City indicate that prevailing winds are from the south-southwest. A representative windrose is shown in Figure 3.3.1. A distinct bimodal trend is not apparent at this location.

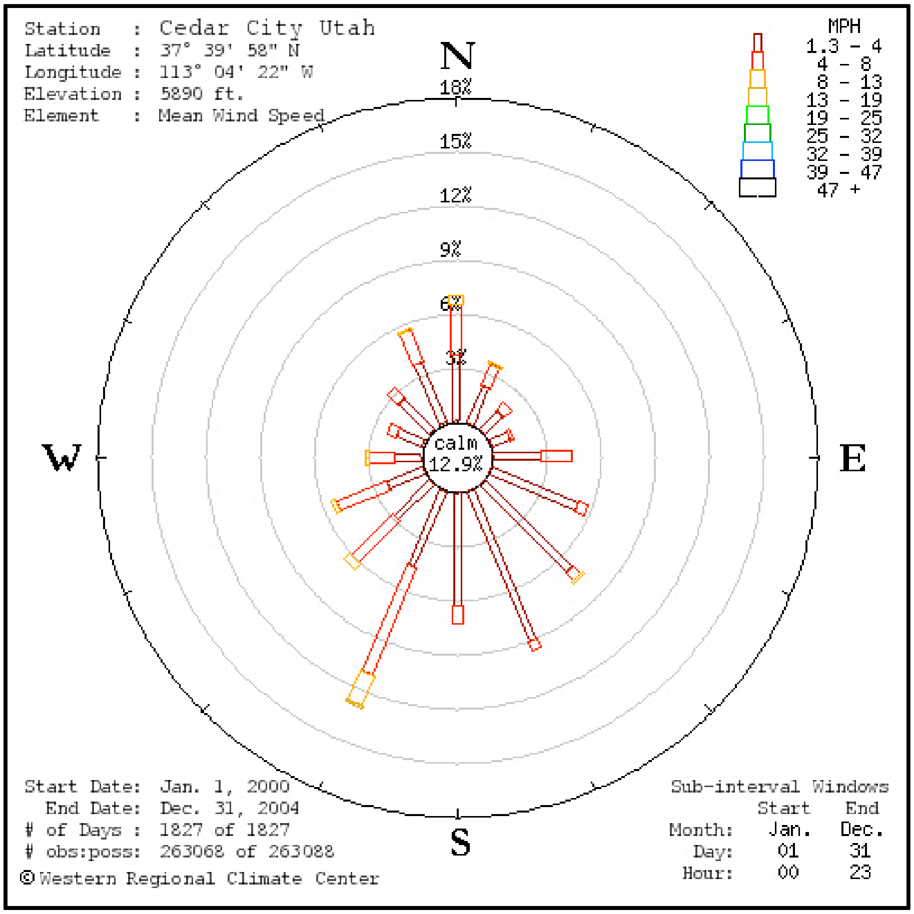

Figure 3.3.1. Windrose generated from Cedar City weather data (Community Environmental Monitoring Program 2011).

3.3.2 Regulatory Requirements

3.3.2.1 NATIONAL AMBIENT AIR QUALITY STANDARDS

EPA established NAAQS for six pollutants known as “criteria” pollutants. They are carbon monoxide (CO), NO_2, ozone (O_3), lead (Pb), sulfur dioxide (SO_2), and PM. PM is defined as fine particulates with a nominal aerodynamic diameter of 10 micrometers or less (PM_{10}), and fine particulates with a nominal aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$). The primary standards for the criteria pollutants are health-based standards. They are set at levels to protect the health of the most sensitive individuals in the population: the very young, the very old, and those with respiratory problems or other ailments. The EPA also established secondary standards for the criteria pollutants. These are the quality of life standards that are the same as the primary standards or less stringent than the primary standards. All of the standards are expressed as concentration and duration of exposure, and most address both short-term and long-term exposure.

NAAQS for the criteria pollutants are presented in Table 3.3.1 (40 CFR 50.1–50.17). With the exception of the PM_{10} values, which are from the UDAQ state permitting documents for the Coal Hollow Mine, recorded concentrations and their associated locations are presented to show that NAAQS pollutant concentrations around the state are generally low at locations similar to the tract. These concentrations are not indicative of air quality at the tract. PM_{10} is currently being monitored at Coal Hollow Mine, and monitoring results are discussed in Chapter 4, Section 4.3.3.1.

When a designated air quality area or airshed within a state exceeds a NAAQS, that area may be designated as a “nonattainment” area. Areas with levels of a criteria pollutant below the health-based standard are designated as “attainment areas.” It is possible for a geographic area to be an attainment area for one criteria pollutant, but a nonattainment area for another. To determine whether an area meets the NAAQS, air-monitoring networks have been established and are used to measure ambient air quality. Monitoring sites, by design, are in areas where high concentrations within a region are expected to occur. The Utah air quality map shows the monitoring station locations within the State of Utah (Map 3.6).

Table 3.3.1. Environmental Protection Agency National Ambient Air Quality Standards and Recorded Concentrations

Pollutant	Standard Value[*, **]	Recorded Concentration[‡]	Location[‡]
CO			
8-hour average	9 ppm (10 mg/m^3)[†]	1 ppm (1,150 $\mu g/m^3$) (estimate)	Kane County
1-hour average	35 ppm (40 mg/m^3)[†]	1 ppm (1,150 $\mu g/m^3$) (estimate)	
NO_2			
Annual arithmetic mean	0.053 ppm (100 $\mu g/m^3$)[†]	17 $\mu g/m^3$ (estimate)	Kane County
1-hour average	0.1 ppm (188 $\mu g/m^3$)[†]	n/a	
O_3			
1-hour average	0.12 ppm (235 $\mu g/m^3$)[†, ††]	n/a[††]	Canyonlands National Park[¥]
8-hour average	0.075 ppm (effective 5/27/2008)	0.072 ppm	
Pb			
Quarterly average	1.5 $\mu g/m^3$	0.08 $\mu g/m^3$	Magna, Salt Lake County[¥¥]
PM_{10}			
Annual arithmetic mean	Revoked[§]	23 $\mu g/m^3$	UDAQ
24-hour average	150 $\mu g/m^3$	72 $\mu g/m^3$	

Table 3.3.1. Environmental Protection Agency National Ambient Air Quality Standards and Recorded Concentrations

Pollutant	Standard Value*, **	Recorded Concentration‡	Location‡
$PM_{2.5}$			
Annual arithmetic mean	12.0 μg/m³§	2.8 μg/m³ §§	Bryce Canyon§§
24-hour average	35 μg/m³§	9.5 μg/m³ §§	
SO_2			
Annual arithmetic mean	0.03 ppm (80 μg/m³)†	5 μg/m³ (estimate)	Kane County‡
24-hour average	0.14 ppm (365 μg/m³)†	10 μg/m³ (estimate)	
1-hour average	75 ppb	n/a	
3-hour average (secondary standard)	0.5 ppm (1,300 μg/m³)†	20 μg/m³ (estimate)	

* CO = primary standard; NO_2, O_3, Pb, and PM = primary and secondary standards; SO_2 = annual arithmetic mean.
Mean and 24-hour average are primary standards, 3-hour average is a secondary standard.
ppm = parts per million; ppb = parts per billion.

† Parenthetical value is an approximate equivalent concentration in micrograms per cubic meter (μg/m³) or milligrams per cubic meter (mg/m³).

‡ Data from (2008, 2010). PM_{10} value is from the UDAQ state permitting for the Coal Hollow Mine.

¥ Data from (NPS 2008a). The recorded value is based on the 4th high.

§ Effective December 14, 2012. Annual mean averaged over three years; 24-hour, 98th percentile averaged over three years.

** The 1-hour NO_2 NAAQS became effective April 12, 2010. The final 1-hour SO_2 NAAQS was signed on June 2, 2010.

†† Data from 40 CFR 50.1–50.17. Applies only in limited areas; as of June 15, 2005, EPA revoked the 1-hour O_3 standard in all areas except the fourteen 8-hour O_3 nonattainment Early Action Compact areas. The tract is not in an Early Action Compact area.

¥¥ Data from (EPA 2005a).

§§ Data from (NPS 2008c). $PM_{2.5}$ background is from the Bryce Canyon National Park IMPROVE Site. The most recent three-year average design values are from 2008.

3.3.2.1.1 Air Quality and Human Health

Air pollution poses known risks to human health. EPA regulates criteria air pollutants and hazardous (or toxic) air pollutants because they are considered harmful to public health and the environment at concentrations above established standards.

Of the six criteria pollutants, PM and O_3 present the most widespread health risks. Studies have linked PM exposure to health problems such as irrigation of the airways, coughing, difficulty breathing, reduced lung function, aggravated asthma, chronic bronchitis, irregular heartbeat, nonfatal heart attacks, and some cancers (EPA 2013f). Research has found that certain populations are more vulnerable to these health effects, such as people with pre-existing heart or lung diseases, children, and older adults. Research has also confirmed links between exposure to $PM_{2.5}$ and increases in respiratory health problems, hospitalizations, and premature death (EPA 2013f).

Specifically for coal workers, exposure to coal mine dust causes various pulmonary diseases, including coal workers' pneumoconiosis and chronic obstructive pulmonary disease. These lung diseases can bring about impairment, disability, and premature death (Department of Health and Human Services 2011).

Atmospheric PM comprises many different chemical components that vary by location and time. In addition, fine- and coarse-fraction PM particles have fundamentally different sources and composition. Based on studies conducted throughout most of the United States, sulfate, ammonium, and hydrogen ions; elemental carbon, secondary organic compounds, and primary organic species from cooking and combustion; and certain metals, primarily from combustion processes, are found predominately in fine particles of ambient PM (EPA 2005b). Crustal-related materials, such as calcium, aluminum, silicon, magnesium, and iron, and primary organic materials such as pollen, spores, and plant and animal debris, are found predominately in coarse particles of ambient PM. Some components, such as potassium and nitrate, may be found in both fine and coarse particles (EPA 2005b). Many PM components can be linked with differing health effects, but the evidence is not yet sufficient to allow differentiation of those components that are more closely related to specific health outcomes (EPA 2012f). Therefore, health effects from particular components of PM cannot be separated out at this time.

Breathing O_3 can trigger a variety of health problems such as chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground-level O_3 also can reduce lung function and inflame the linings of the lungs. Repeated exposure to O_3 may permanently scar lung tissue (EPA 2012d).

Exposure to CO can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues. At extremely high levels, CO can cause death (EPA 2012c). Current scientific evidence links short-term NO_2 exposures (ranging from 30 minutes to 24 hours) with adverse respiratory effects, such as airway inflammation in healthy people and increased respiratory symptoms in people with asthma. Also, studies show a connection between breathing elevated short-term NO_2 concentrations with increased visits to emergency departments and hospital admissions for respiratory issues, especially asthma (EPA 2013d). Current scientific evidence links short-term exposures to SO_2 (ranging from 5 minutes to 24 hours) with adverse respiratory effects, including bronchoconstriction and increased asthma symptoms. Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations such as children, the elderly, and asthmatics (EPA 2012g).

Depending on the level of exposure, lead can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems, and the cardiovascular system. Lead exposure also affects the oxygen carrying capacity of the blood. Infants and young children are especially sensitive to even low levels of lead, which may contribute to behavioral problems, learning deficits, and lowered IQ (EPA 2012e).

With regard to hazardous air pollutants (HAPs), people exposed at sufficient concentrations and durations may have an increased chance of getting cancer or experiencing other serious health effects. These health effects can include damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, respiratory, and other health problems (EPA 2012a).

Because NAAQS are the legal guidelines that have been established to protect human health and the environment from criteria air pollutants, the air quality analysis in Chapter 4 examines compliance with the NAAQS. Action alternatives that are compliant with the NAAQS are assumed to be protective of human health and the environment. HAP emissions have been compared with known health exposure levels (from the EPA's Integrated Risk Information System) to provide an assessment of potential impacts on human health.

3.3.2.2 CLASS I AREAS AND CLASS II AREAS

Clean air designations were established under the federal CAA Title I, Part C, Prevention of Significant Deterioration (PSD) of Air Quality. Generally, the Class I air quality and land use classification is the designation for clean, pristine airsheds and would permit little or no development, and the Class II designation is applied to all other clean airsheds (in attainment of the NAAQS) where development is permitted under state authority. Class I areas include national parks larger than 6,000 acres, national wilderness areas larger than 5,000 acres, and international parks and national memorial parks larger than 5,000 acres. Except for fires and wind erosion, the only potential for adverse air quality impacts in Class I areas is from anthropogenic pollutants transported into these areas by large-scale winds, local winds, or both. Areas in the United States that have ambient air quality concentrations greater than those specified in the NAAQS are designated as nonattainment areas; the remainder of the country is designated Class II.

3.3.2.3 PREVENTION OF SIGNIFICANT DETERIORATION

In addition to the NAAQS discussed above, the EPA promulgated PSD regulations to further protect and enhance air quality. The PSD regulations use an incremental approach and are intended to help maintain good air quality in areas that attain the national standards and to provide special protections for national parks. These increments establish the maximum increase in pollutant concentration allowed above a baseline level. Complete consumption of an increment would impose a restriction to growth for the affected area. It does not necessarily indicate an adverse health impact. PSD permits are required for major, new stationary sources of emissions that emit 250 tons (100 tons for some specific sources) or more per year of a criteria air pollutant where the source is in an attainment or unclassifiable area. Increment consumption for major sources is tracked by the State of Utah as permits are issued. The maximum allowable PSD increments over baseline are in Table 3.3.2.

Table 3.3.2. Prevention of Significant Deterioration of Air Quality Increments: Maximum Allowable Increase (μg/m^3)

Pollutant	Averaging Time	Class I	Class II
PM_{10}	24 hour	8	30
$PM_{2.5}$	Annual	n/a	n/a
	24 hour	n/a	n/a
SO_2	Annual	2	20
	24 hour	5	91
	3 hour	25	512
NO_2	Annual	2.5	25

3.3.2.4 AIR QUALITY–RELATED VALUES

Federal land managers have identified AQRVs to be protected in federal areas such as national parks and national forest Class I areas. AQRVs are scenic, cultural, physical, biological, ecological, or recreational resources that may be affected by a change in air quality, as defined by the federal land manager. Specific AQRVs of concern are dependent on a number of variables, including the evolving state of the science, project-specific pollutants, site-specific management concerns, and the existing condition of the AQRVs. Refer to Section 3.3.3 Existing Air Quality for a discussion of specific AQRVs (visibility, acid deposition, acid neutralizing capacity, flora, and fauna).

3.3.2.5 GLOBAL CLIMATE CHANGE

Scientific investigation continues concerning the rise in global mean temperatures, the causes of this rise, and whether a warming trend will continue. Greenhouse gases (GHGs) have been identified as a contributor to the rise in global mean temperatures. Ongoing scientific research has identified the potential impacts of anthropogenic (from human activities) GHG emissions and changes in biologic carbon sequestration on the global climate. Through complex interactions on a regional and global scale, these changes are likely causing a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space, much as glass traps heat over a greenhouse.

GHGs absorb infrared radiation and trap its heat in the atmosphere. Many gases exhibit GHG properties; some occur naturally, such as carbon dioxide (CO_2), CH_4, water vapor, O_3, and nitrous oxide (N_2O). Others are synthetic, such as chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Some of the naturally occurring GHGs are also produced by anthropogenic activities. The study of global climate change is complex because there are many factors that may contribute to changes in the earth's temperature, including the emission of GHGs, as well as the earth's ability to remove these gases from the atmosphere through mechanisms such as photosynthesis and ocean uptake. Analysis of climatic change comprises several factors, including GHG emissions, land use management practices, and the albedo effect (i.e., the cycle of increased temperature resulting from the increased absorption of normally reflected light).

The predominant GHGs emitted in the United States are CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. In the United States, anthropogenic GHG emissions come primarily from burning fossil fuels, which accounted for 94% of CO_2 emissions in 2011. Globally, the United States accounted for approximately 18% of the CO_2 added to the atmosphere through the combustion of fossil fuels in 2010 (EPA 2013c).

CH_4 emissions from landfills, coal mines, oil and natural gas operations, and agriculture accounted for 9% of United States GHG emissions in 2011. N_2O emitted from agricultural and industrial activities, as well as during the combustion of fossil fuels and solid waste, accounted for 5% of total 2011 GHG emissions. Several human-made fluorinated gases accounted for 2% of the total (EPA 2013e).

GHG inventories are usually reported in terms of "CO_2 equivalents" to account for the relative global warming potential (GWP), or a given pollutant's ability to trap heat. For example, CH_4 has a GWP of 21, meaning it is 21 times more effective at trapping heat than CO_2. N_2O has a GWP of 310, meaning it is 310 times more effective at trapping heat than CO_2. Hydrofluorocarbons range from 140 to 11,700 GWP, whereas perfluorinated compounds range from 6,500 to 9,200 GWP.

There are many regional sources that may contribute to global climate change, including those sources presented in Table 3.3.3. It is likely that all of the sources discussed above for the United States would be found near the tract or within the State of Utah.

3.3.3 Existing Air Quality

3.3.3.1 BACKGROUND AIR QUALITY AND REGIONAL SOURCES

Existing air quality near the tract is expected to be typical of undeveloped regions in the western United States. Limited data collected in typical undeveloped areas indicate that ambient pollutant levels are usually near or below measurable limits. Locations vulnerable to decreasing air quality include areas adjacent to surface-disturbing activities, such as energy and mineral development projects, farm tilling, and local population centers affected by residential emissions.

Data from the 2011 UDAQ statewide emissions inventory report for Kane County and Utah are shown in Table 3.3.3. The report summarizes criteria pollutant levels in tons per year (TPY) by source type. The data illustrate that emissions in Kane County are a small percentage of statewide totals.

The greatest sources of NO_x and PM_{10} in Kane County are onroad mobile sources (automobiles and trucks traveling on established roads) and area sources (small mobile and stationary sources such as gas stations or wood burning).

Local sources of air pollution include automobiles, trains, generators, and wood burning stoves and fireplaces (in the winter). These sources typically generate CO, NO_2 and other NO_x, volatile organic compounds (VOCs), and PM_{10}. Additionally, O_3, a highly reactive form of oxygen, typically forms when NO_x and VOC emissions from these sources react with sunlight on hot, still days. With the removal of leaded gasoline in the marketplace, and the absence of industries such as nonferrous smelters and battery plants, airborne-lead pollution is not an issue of concern in the area. In fact, lead is currently monitored only in Salt Lake County, Utah (EPA 2005a).

The tract is classified as attainment for all criteria pollutants. No state monitoring stations exist near the tract. Background air quality levels are derived from several sources, as identified in the footnotes of Table 3.3.1. Concentrations are also presented in Figure 3.3.2.

Table 3.3.3. 2011 Summary of Emissions by Source (tons per year) for Kane County and Utah

Location	Source	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
Kane County	Area source	1,329.38	42.03	617.53	226.83	23.62	498.46
	Nonroad mobile	1,968.02	87.02	21.43	19.85	0.54	695.11
	Onroad mobile	1,662.00	506.70	24.06	20.06	1.72	157.98
	Point source	4.24	18.14	17.44	2.54	2.97	0.60
	Biogenics	9,133.20	0.00	0.00	0.00	0.00	47,897.91
	Wildfires	21.24	0.60	2.57	2.31	0.00	3.63
	Total	**14,118.08**	**654.50**	**683.04**	**271.59**	**28.85**	**49,253.69**
Utah Total	Area source	35,123.64	8,379.32	37,990.71	9,935.03	949.72	49,702.14
	Nonroad mobile	129,500.14	19,507.12	1,627.11	1,533.44	759.02	22,628.88
	Onroad mobile	284,789.60	68,109.31	3,489.90	2,732.85	332.82	25,282.43
	Point source	28,181.29	69,519.51	9,356.69	4,771.06	25,109.88	5,667.66
	Biogenics	136,583.55	0.00	0.00	0.00	0.00	754,396.36
	Wildfires	11,562.59	329.18	1,399.03	1,259.13	0.00	1,975.10
	Total	**625,740.81**	**165,844.44**	**53,863.43**	**20,231.51**	**27,151.44**	**859,652.57**
Kane County Percentage of Utah		2.3%	0.4%	1.3%	1.3%	0.1%	5.7%

Source: UDAQ (2011).

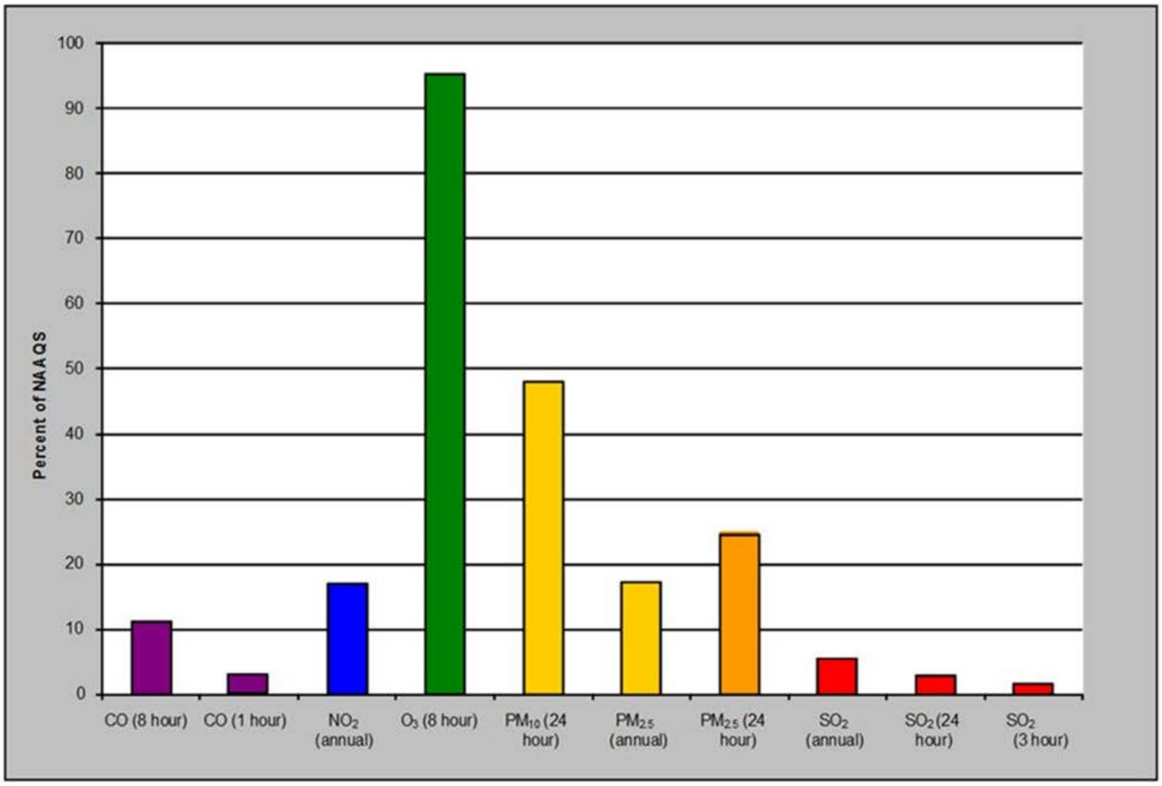

Figure 3.3.2. Background concentrations of criteria pollutants.

The location of the tract is designated as a Class II area for the criteria pollutants. There are several Class I and sensitive Class II parks near the tract, including Bryce Canyon, Zion, Capitol Reef, and Grand Canyon national parks (all Class I), and Grand Staircase-Escalante National Monument (Class II). The closest Class I area is Bryce Canyon National Park, which is approximately 16.1 km (10 miles) from the tract. This distance is measured from the tract to the southwest boundary of the park. There are many regional sources that may impact the Class I areas near the tract. Table 3.3.4 lists point source emissions sources within 50 km (31 miles) of the Class I areas with emissions greater than PSD thresholds (emissions greater than 250 TPY of an air pollutant), as they existed during a 1996 study with available updates noted in the table. PSD sources have the potential for significant impact, and more restrictive permitting requirements are generally imposed. No additional PSD sources were found as part of this air quality analysis. The largest contributors to air pollutant emissions in the region are power plants and generating stations (WRAP 1996).

Table 3.3.4. Sources Near the National Park Class I Areas: Bryce, Zion, Capitol Reef, Grand Canyon

Facility (Class I area in parentheses)	Emissions (TPY)				
	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Carbon Power Plant Helper, Utah (Capitol Reef)*	18	3,380	6,765	221	38.8
Chemical Lime Co. Nelson Lime Plant, Arizona (Grand Canyon)	16.9	719	122.2	355.7	188.5
El Paso Natural Gas Co. Environmental AF, Arizona (Grand Canyon)	975.6	2,556.4	0.5	0	0
El Paso Natural Gas Company Flagstaff Co, Arizona (Grand Canyon)	28.9	1,068.2	0.2	0	0
El Paso Natural Gas Company Hackberry Co, Arizona (Grand Canyon)†	14.2	461.0	0.3	10.7	0
El Paso Natural Gas Company Williams Com, Arizona (Grand Canyon)	19.6	1,508.4	0.6	0	0
Hunter Power Plant, Castle Dale, Utah (Capitol Reef)*	130	19,869	7,029	1,226	583.2
Huntington Power Plant, Huntington, Utah (Capitol Reef)*	82	11,198	13,714	1,067	341.8
Intermountain Generation Station (Delta, Utah) (Capitol Reef)	0.4	19,688.3	3,758.8	100.5	19.0
Moab Compressor Station, Moab, Utah (Capitol Reef)	17.1	470.4	0	2.3	2.3
Navajo Power Plant, Page, Arizona (Bryce, Zion, Capitol Reef, Grand Canyon)‡	196.4	34,744	3,843	1,560.7	708.1
Phoenix Cement Portland Cement Plant, Arizona (Grand Canyon)	0	2,628.3	196.5	179	94.9
Reid Gardner, Nevada (Bryce, Zion, Grand Canyon)	49.8	14,288.3	3,547.1	874.1	874.1
Transwestern Pipeline Company, Arizona (Grand Canyon)	59.1	1,319.9	1.1	2	1.4

Source: WRAP (1996), except as noted below.

* VOC, NO_x, SO_2, and PM_{10} emissions updated data from USFS (2009).

† VOC, NO_x, SO_2, and PM_{10} emissions updated data from EPA (2009).

‡ O_x and SO_2 emissions updated with 2006 emissions data from Sourcewatch (2009).

Projected emissions for the Coal Hollow Mine are presented in Table 3.3.5. Based on the potential emissions, the facility would not be a major emissions source under the PSD or Title V programs. This mine would not be in operation during the operation of the tract.

Table 3.3.5. Coal Hollow Mine Potential to Emit

Emissions (TPY)					
VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO
5.5	26.1	31.5	75.65	10.5	9.1

Note: Actual monitored quarterly PM_{10} values from the Coal Hollow Mine are presented in Section 4.3.3.1.

3.3.3.2 VISIBILITY

Visibility is the degree to which the atmosphere is transparent to visible light. Visibility is a measure of how far and how well one can see. Pollutant particles and aerosols scatter and absorb light, which impairs visibility (NPS 2012a). It is an important air quality value, particularly in scenic and recreational areas. Scenic vistas in most United States parklands can be diminished by haze, which reduces contrast, dilutes colors, and reduces the distinctness or visibility of distant landscape features. Visibility degradation in national park lands and forests is a consequence of broader, regional-scale visibility impairment from visibility-reducing particles and their precursors often carried long distances to these remote locations.

Sulfates, organic matter, elemental carbon (soot), nitrogen compounds, soil dust, and their interaction with water cause most anthropogenic visibility impairment. The causes and severity of visibility impairment vary over time and from one place to another, depending on weather conditions, sunlight, and the size and proximity of emission sources.

Visibility protection requirements are included in EPA PSD regulations, which require protection of AQRVs for Class I areas. These AQRV impacts are subjective and intended to be used as guidelines for assessing potential project impacts and not as definitive regulatory thresholds. A threshold change in light extinction of 5% or more contributes to regional haze visibility impairment, and a threshold change of 10% or more causes visibility impairment, as described in the Federal Land Managers Air Quality Related Values Work Group (FLAG) 2010 guidance (USFS et al. 2010). Unlike NAAQS standards and PSD increments, an exceedance of the threshold does not, by itself, cause a project to be halted. Regulatory factors and contextual considerations (e.g., current pollutant concentrations and AQRV impacts, air quality trends in the area, expected life of the source, stringency of the emission limits, emission changes in the area, and public comments) must also be evaluated. As discussed in the previous section, the Bryce Canyon, Zion, Capitol Reef, and Grand Canyon national parks (all Class I) and the Grand Staircase-Escalante National Monument (Class II) are near the tract. The State of Utah has addressed both visibility and regional haze in the Class I areas in two state implementation plans. The *Utah State Implementation Plan Section XVII Visibility Protection* report (State of Utah 1993) addresses visibility protection of Utah's natural features and uses a two-phased approach. The first phase implements a visibility monitoring strategy and considers direct plume impacts on visibility from proposed new sources. The second phase addresses the development of a long-term plan to show progress toward national visibility protection goals. This document is still in force but has not been revised since 1993.

More current information is available in the revised *Utah State Implementation Plan Section XX Regional Haze* (State of Utah 2008). This document contains measures addressing regional haze visibility impairment to ensure that the state makes reasonable progress toward national goals. The state has implemented long-term strategies to reduce regional haze resulting from various air pollution sources. For most Class I areas in the region, stationary source NO_x and PM emissions are not considered a major contributor to visibility impairment on the average 20% best and 20% worst days; although, on some of the worst days, nitrates and PM are the main components of visibility impairment. Pollutant projections affecting regional haze, as identified in the state implementation plan, include the following:

- 33% decrease in Utah sources and 53% decrease in SO_2 emissions for the nine states in the Grand Canyon Visibility Transport Commission (GCVTC) between 1996 and 2018
- 36% decrease in Utah sources and 57% decrease in NO_x emissions for the nine states in GCVTC between 1996 and 2018
- 38% decrease in Utah sources and 31% decrease in $PM_{2.5}$ emissions for the nine states in GCVTC between 1996 and 2018
- Visibility improvement for the 20% best and worst days for each of the Class I areas (Bryce Canyon, Zion, Capitol Reef, and the Grand Canyon national parks) between 1996 and 2018

The State of Utah's reductions in SO_2 are primarily due to that state's long-term strategy for stationary sources of SO_2 (State of Utah 2008). Reductions in NO_x and $PM_{2.5}$ have resulted from the implementation of new federal engine standards and fuel standards; however, stationary source NO_x emissions are projected to increase by 4% between 1996 and 2018 (State of Utah 2008). Although stationary source PM emissions are projected to increase, they likely cause less than 2% of the regional visibility impairment (State of Utah 2008).

The NPS Air Resources Division defines the desired condition for visibility as < 2 deciviews above natural conditions on average visibility days. From 2005 to 2009 at Bryce Canyon National Park, the average visibility was 3.7 deciviews above natural conditions and therefore did not meet the desired condition (NPS 2012a). From 2000 to 2009, visibility on the 20% clearest days did improve significantly, but remained unchanged on the 20% haziest days (NPS 2012a). Visitor surveys have consistently concluded that good visibility and clean air are very important to the park experience (NPS 2012a).

3.3.3.3 ACID DEPOSITION

Air pollution is produced when acid chemicals are incorporated into rain, snow, fog, mist, dust, or smoke. Some of this air pollution falls to the ground as acid deposition. Atmospheric deposition of air pollutants can increase the acidity of soils and water resources. The acid comes from sulfur oxides (SO_x), NO_x, products of burning coal and other fuels, and from certain industrial processes. Wet deposition refers to acidic rain, fog, snow, or mist. Dry deposition occurs when acid chemicals are incorporated into dust or smoke (usually in areas where the weather is dry). Title IV of the CAA sets a goal of reducing annual SO_2 emissions by 10 million tons below 1980 levels. To achieve these reductions, the law requires a two-phase tightening of the restrictions placed on fossil fuel–fired power plants.

Measurements of atmospheric deposition are currently being taken in Class I areas of Grand Canyon and Bryce Canyon national parks by the National Acid Deposition Program. The *2008 Annual Performance & Progress Report: Air Quality in National Parks* (NPS 2009a) indicates that rates of atmospheric deposition of nitrogen and sulfur in rain are relatively low in Bryce Canyon National Park, but are elevated above natural conditions. Trends analyses for both Bryce Canyon and Grand Canyon national parks show that the deposition of nitrogen and sulfur has no statistical trend between 1998 and 2007 (NPS 2009a). A March 2012 *Air Quality Resources at Bryce Canyon National Park* briefing paper contains more recent nitrogen and sulfur data (NPS 2012a). From 2005 to 2009, estimated wet nitrogen deposition in Bryce Canyon National Park was 1.7 kilogram (kg)/hectare(ha)/year, and estimated wet sulfur deposition was 0.7 kg/ha/year. The NPS's desired condition for both nitrogen and sulfur wet deposition is defined as < 1 kg/ha/year. Current total nitrogen deposition (wet plus dry) at Bryce Canyon National Park is estimated to be 2.5 kg/ha/year. From 2000 to 2009, nitrate decreased significantly and sulfate was relatively unchanged.

Kane County does not have significant sources of acid deposition; however, there are significant, nearby regional power plants that are listed in Table 3.3.4. Regional acid deposition sources in Utah include the Carbon Power Plant (Phase II acid rain source that has been issued a Phase I acid rain permit by the EPA for early NO_x reduction), the Hunter Power Plant (Phase II acid rain source), the Huntington Power Plant (Phase II acid rain source), and the Intermountain Generation Station (Group I [dry bottom, wall-fired, tangential boilers], Phase II acid rain source) (UDAQ 2009). Phase I began in 1995 and affected mostly coal-burning electric utility plants. Phase II sources consist of existing utility units serving generators with an output capacity of greater than 25 mW, and all new utility units (EPA 2012b). The acid deposition provisions for these facilities refer to coal-fired utility units that are subject to an acid rain emission limitation or reduction requirement for SO_2 under the CAA. Although there are significant acid deposition sources in the region, the tract would not be considered a significant acid deposition source.

3.3.3.4 FLORA AND FAUNA

Pollutant emissions from larger point sources may impact flora and fauna at the Class I areas; however, the sensitivity of ecosystem response to increased pollutant emissions from these particular sources is not well documented. Because emissions from the tract would be a small percentage of the existing regional sources, an in-depth review of these regional sources was not performed.

3.3.3.5 GENERAL CONFORMITY

To eliminate or reduce the severity and number of NAAQS violations in nonattainment areas and to achieve expeditious attainment of the NAAQS, the EPA promulgated the Conformity Rule (40 CFR 6, 51, 93). The Conformity Rule applies to federal actions and environmental analyses, in nonattainment areas, completed after March 15, 1994. This rule contains a variety of substantive and procedural requirements to show conformance with both the NAAQS and state implementation plans. The nonattainment/maintenance areas in Utah (Reiss 2013; UDAQ 2013b) are as follows:

- $PM_{2.5}$: part of Utah County; part of Cache County in Utah, and Franklin County in Idaho; and Salt Lake, Davis, and parts of Weber, Box Elder, and Tooele counties are nonattainment.
- PM_{10}: Salt Lake and Utah counties and Ogden (Weber County) are nonattainment.
- SO_2: Salt Lake County and the east portion of Tooele County (above 5,600 feet) are nonattainment. Redesignation is pending for Salt Lake County.
- CO: Ogden City (maintenance area redesignated in 2001); Salt Lake City (maintenance area redesignated in 1999); and Provo and Orem in Utah County (maintenance area redesignated 2006).
- O_3: Davis and Salt Lake counties (maintenance areas redesignated 1997).

The tract is in Kane County. This county is in attainment of the NAAQS for all criteria pollutants, as defined under the EPA.

3.3.3.6 GREENHOUSE GASES

According to the EPA, over the last century, the average annual temperature in the Southwest (defined as Utah, California, Nevada, parts of Colorado, Arizona, parts of New Mexico, and parts of Texas) has increased approximately 1.5°F (EPA 2013a). The average annual temperature is projected to rise an additional 2.5°F–8.0°F by the end of the century. Warming has already contributed to decreases in spring snowpack and Colorado River flows. Warming in the Southwest is projected to be greatest in the summer, and future warming is projected to produce more severe droughts in the region, with reductions in water supplies (EPA 2013a). In general, the EPA indicates the following:

- Increasing temperatures and more frequent, severe droughts will likely worsen existing competition for water resources.
- Drought, wildfire, changes in species' geographic ranges, invasive species, and pests will likely threaten native Southwest forests and ecosystems.
- It may become difficult for the Southwest's growing cities to attain air quality standards and meet energy and water demands.
- Climate change poses threats to the region's native peoples, infrastructure, agriculture, and recreational activities (EPA 2013a).

In Utah, the average temperature from approximately 1997 to 2007 was higher than observed during any comparable period of the past century and was roughly 2°F higher than the 100-year average (Blue Ribbon Advisory Council 2007). Utah is projected to warm more than the average for the entire planet and more than the coastal regions of the contiguous United States. The expected consequences of this warming are fewer frost days, longer growing seasons, and more heat waves. Ongoing GHG emissions at or above current levels will likely result in the following: 1) a decline in Utah's mountain snowpack and 2) a possible severe, prolonged, episodic drought (Blue Ribbon Advisory Council 2007).

Weather data collected over the past six or seven decades at Bryce Canyon National Park indicate a trend toward fewer days with complete freeze/thaw cycles, from an average of approximately 203 days in 1955 to approximately 177 days in 2010 (10-year averaging). Fewer frost days in long-term weather patterns could impact geologic processes in Bryce Canyon National Park. Annual mean minimum temperatures have increased from an average of approximately 25°F in 1955 to approximately 29°F in 2010; annual mean maximum temperatures have slightly decreased from an average of approximately 57°F to approximately 56°F during the same time period (10-year averaging). Annual total precipitation has decreased from approximately 110 inches to 80 inches from 1945 to 2010 (10-year averaging) (NPS/NOAA 2013). Temperature and precipitation changes could impact vegetation, soils, wildlife, and other resources in Bryce Canyon National Park.

Climate change analyses comprise several factors, including GHGs (which include CH_4 and CO_2), land use management practices, and the albedo effect (reflectivity of the surface, by vegetation or water). The tools necessary to quantify incremental climatic impacts of specific activities associated with those factors are presently unavailable (i.e., existing climate prediction models are not at a scale sufficient to estimate potential impacts of climate change within the analysis area). Research on how GHG emissions influence global climate change and associated effects has focused on the overall impact of emissions from aggregate regional or global sources. GHG emissions from single sources are small relative to aggregate emissions, and GHGs, once emitted from a given source, become well mixed in the global atmosphere and have a long atmospheric lifetime. The climate change research community has not yet developed specific tools for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. Also, scientific literature that addresses the climate effects of individual, facility-level GHG emissions has not been identified. The current tools for simulating climate change generally focus on global and regional-scale modeling. Global and regional-scale models lack the capability to represent important small-scale processes. As a result, confidence in regional- and subregional-scale projections is lower than at the global scale. There is thus limited scientific capability in assessing, detecting, or measuring the relationship between emissions of GHGs from a specific single source and any localized impacts. As a consequence, impact assessment of effects of specific anthropogenic activities cannot be performed. Therefore, climate change analysis for the purpose of this document is limited to accounting for and disclosing the factors that contribute to climate change. Qualitative and/or quantitative evaluations of potential contributing factors within the planning area are included where appropriate and practicable.

The CEQ published the document *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* in February 2010. Although the BLM does not use draft guidance for analysis because of the potential for change before it is finalized, elements of the guidance are incorporated into the climate change analysis, including the quantification of emissions over the life of the project, inclusion of mitigation measures to reduce GHG emissions, and qualitative discussions of the link between GHG emissions and climate change.

3.4 Cultural Resources

Investigations to identify and evaluate cultural resources in the Alton Coal Tract were conducted in 2005 and 2008 by Montgomery Archaeological Consultants, Inc. on behalf of ACD (Stavish 2008a; Stavish 2007), and supplemental work was conducted by the BLM-KFO in 2007 (Zweifel 2007). The cultural resources identified on the tract during these investigations consist of prehistoric and historic archaeological sites. A programmatic agreement (PA) that defines the area of potential effects (APE) for the Alton Coal Tract LBA and that details the processes by which BLM will consider the effects of the undertaking on historic properties has been developed and is provided in Appendix M. As defined in the PA, the APE for the Alton Coal Tract LBA comprises the following:

- The entire proposed tract and a buffer extending 1 mile from the external boundaries of the tract
- The reasonably foreseeable haul route along US-89, SR-20, I-15, and SR-56 and a buffer extending 500 feet on each side of the haul route highway centerlines
- The Panguitch Historic District
- The town of Alton, Utah
- The town of Hatch, Utah

The APE, as defined in the PA, provides consideration for effects to cultural resources that may be affected by mine-related actions, include the Panguitch Historic District, which is listed on the NRHP, and Utah Heritage Highway 89 (also known as US-89) with its associated Mormon Pioneer Heritage Area.

3.4.1 Regional Overview

The tract lies in the Grand Staircase section of the Colorado Plateau Semidesert Province (Stokes 1986). An overview of the region’s geology and soils, particularly with regard to the impact of surficial and bedrock units on the distribution of cultural resources in the area, is presented as Appendix C of the Montgomery Archaeological Consultants, Inc. 2005 inventory report (Lamm 2005 in Stavish 2007). The two most prominent geologic units in the region are alluvium and Tropic Shale. The 2005 report describes the possible natural impacts to cultural resources distributed on the alluvium. These include the localized slope failure or collapse of arroyo walls, the piping of finer grained sediments, the entrenching of drainages, and the potential for buried sites. Potential impacts to cultural resources distributed across the Tropic Shale include localized slope failure, surficial creep and slope wash on steeper slopes, and erosion of weathered bedrock on steep to gentle slopes. Moreover, the vertical erosion of in-situ sediments on the Tropic Shale may also distort the integrity of buried cultural resources.

3.4.1.1 CURRENT LAND USES AND IMPACTS

Current land uses in the Alton Amphitheatre and Sink Valley include farming, ranching, and mining. Over 20% of the land in the tract consists of agricultural lands, whereas cattle and other livestock graze on private farmlands and on BLM-managed pasturelands. Historic coal mining has also been conducted in the area, and three historic archaeological resources have been recorded: the Smirl Mine (42Ka4017), the Jacob A. Sorenson Mine (42Ka4019), and the Alton Mine (42Ka4091). The remnants of these mines have since been reclaimed by ongoing activities, and no evidence of their existence was documented during the 2005 cultural resource inventory (Stavish 2007).

3.4.2 Known Cultural Resources

3.4.2.1 CULTURAL-HISTORICAL OVERVIEW

A detailed review of the region's culture history and associated references is provided in Stavish (Stavish 2008b; Stavish 2007). Nonetheless, it is useful to recap that human occupation of the region is represented by the Paleoindian, Archaic, Formative, Protohistoric, and Historic cultural periods, possibly beginning as early as 11,500 years before present (BP) or earlier. Recorded sites in the tract likely date from the Early Archaic (beginning ca. 7800 BP) through Historic periods, and also include evidence for Middle and Late Archaic, Anasazi, Fremont, Numic (or Southern Paiute) activities and occupations.

3.4.2.2 ARCHAEOLOGICAL SITES IDENTIFIED IN THE TRACT

Details of the previously conducted cultural resource surveys in the tract are provided in Stavish (2008b). In all, 132 archaeological sites have been identified in the tract; Table 3.4.1 provides a list of these sites (from Stavish 2007; Stavish 2008a; Zweifel 2007).

Table 3.4.1. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA1267	Multicomponent	Eligible	BLM	Numic lithic scatter and historic trash dump
42KA1313	Prehistoric	Eligible	BLM	Archaic, Anasazi Pueblo II, Numic temporary camp
42KA1314	Prehistoric	Eligible	BLM	Southern Paiute temporary camp, lithics, ground stone, ceramics
42KA2038	Prehistoric	Eligible	BLM	Southern Paiute
42KA2039	Prehistoric	Eligible	BLM	Late Archaic, Numic
42KA2040	Prehistoric	Eligible	Private	Southern Paiute lithic and pottery scatter
42KA2041	Prehistoric	Eligible	BLM, Coal Hollow	Anasazi, Southern Paiute
42KA2043	Prehistoric	Eligible	BLM, Coal Hollow	Numic lithic scatter
42KA2044	Prehistoric	Eligible	BLM, Coal Hollow	Archaic temporary camp
42KA2045	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA2047	Prehistoric	Eligible	BLM	Lithic scatter
42KA2048	Prehistoric	Eligible	BLM	Lithic scatter
42KA2049	Prehistoric	Eligible	BLM	Early Archaic lithic scatter
42KA2050	Multicomponent	Eligible	BLM	Archaic lithic scatter and historic herder camp
42KA2051	Prehistoric	Eligible	BLM, Private	Lithic scatter
42KA2052	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA2055	Prehistoric	Eligible	BLM	Archaic, Fremont, Southern Paiute
42KA2056	Prehistoric	Eligible	BLM	Fremont, Numic temporary camp
42KA2057	Prehistoric	Eligible	BLM	Anasazi, Southern Paiute
42KA2058	Multicomponent	Eligible	BLM	Late Archaic Lithic and Historic trash dump
42KA2059	Prehistoric	Eligible	BLM	Lithic scatter
42KA2065	Prehistoric	Eligible	BLM	Archaic, Anasazi, Fremont, Southern Paiute
42KA2066	Prehistoric	Eligible	BLM	Lithic scatter

Table 3.4.1. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA3097	Prehistoric	Eligible	Other fee coal, private	Archaic, Anasazi, Southern Paiute lithic scatter
42KA3115	Prehistoric	Eligible	Private	Temporary camp. Lithic scatter
42KA3168	Prehistoric	Eligible	BLM	Anasazi artifact scatter
42KA3169	Prehistoric	Eligible	BLM	Anasazi, Paiute, Lithic and ceramic scatter with hearths
42KA3170	Prehistoric	Eligible	BLM	Anasazi lithic scatter
42KA3171	Prehistoric	Eligible	BLM	Anasazi temporary camp. Lithic scatter
42KA3172	Prehistoric	Eligible	BLM, Coal Hollow	Southern Paiute temporary camp. Lithic scatter, ceramics
42KA3174	Prehistoric	Eligible	BLM	Temporary camp. Lithic scatter, ground stone
42KA3175	Prehistoric	Eligible	BLM	Southern Paiute temporary camp. Lithic scatter, ground stone
42KA6072	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6073	Prehistoric	Eligible	Private	Lithic scatter
42KA6074	Prehistoric	Eligible	Private	Lithic scatter
42KA6075	Prehistoric	Eligible	Private	Lithic scatter
42KA6076	Prehistoric	Eligible	Private	Lithic scatter
42KA6077	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6078	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6079	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6080	Prehistoric	Eligible	BLM, other fee coal	Archaic, Numic temporary camp
42KA6081	Prehistoric	Eligible	BLM, private	Lithic scatter
42KA6082	Historic	Not Eligible	Private	Corral
42KA6083	Prehistoric	Eligible	BLM	Lithic scatter
42KA6084	Prehistoric	Eligible	BLM	Southern Paiute
42KA6085	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6086	Historic	Not Eligible	BLM, private	Bridge
42KA6087	Prehistoric	Eligible	BLM	Lithic scatter
42KA6088	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6089	Prehistoric	Eligible	BLM	Temporary camp
42KA6090	Prehistoric	Eligible	BLM	Temporary camp
42KA6091	Prehistoric	Eligible	BLM	Early Archaic temporary camp
42KA6092	Prehistoric	Eligible	BLM	Lithic scatter
42KA6093	Prehistoric	Eligible	Private	Lithic scatter
42KA6094	Prehistoric	Eligible	BLM	Early Archaic lithic scatter
42KA6095	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6096	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6097	Prehistoric	Eligible	BLM	Lithic scatter
42KA6098	Prehistoric	Eligible	BLM	Temporary camp

Table 3.4.1. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA6099	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6100	Prehistoric	Not Eligible	BLM	Archaic lithic scatter
42KA6101	Prehistoric	Eligible	BLM	Lithic scatter
42KA6102	Prehistoric	Eligible	BLM	Lithic scatter
42KA6103	Prehistoric	Eligible	BLM	Lithic scatter
42KA6104	Prehistoric	Eligible	Coal Hollow, private	Archaic lithic scatter
42KA6109	Prehistoric	Eligible	BLM, Coal Hollow	Lithic scatter
42KA6110	Prehistoric	Eligible	BLM	Lithic scatter
42KA6111	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6112	Prehistoric	Eligible	BLM	Lithic scatter
42KA6113	Multicomponent	Eligible	BLM	Lithic scatter, Historic trash dump
42KA6114	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6115	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6116	Prehistoric	Eligible	BLM	Lithic scatter
42KA6117	Prehistoric	Eligible	BLM	Fremont lithic scatter
42KA6118	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6119	Prehistoric	Eligible	BLM	Lithic scatter
42KA6120	Prehistoric	Eligible	BLM	Lithic scatter
42KA6121	Prehistoric	Eligible	BLM	Lithic scatter
42KA6122	Prehistoric	Eligible	BLM	Lithic scatter
42KA6123	Prehistoric	Eligible	BLM	Lithic scatter
42KA6125	Prehistoric	Eligible	BLM	Lithic scatter
42KA6126	Prehistoric	Eligible	BLM, Coal Hollow	Anasazi, Southern Paiute temporary camp
42KA6127	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6128	Prehistoric	Eligible	BLM	Lithic scatter
42KA6129	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6130	Prehistoric	Eligible	BLM	Lithic scatter
42KA6131	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6132	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6133	Prehistoric	Eligible	BLM	Lithic scatter
42KA6134	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6135	Multicomponent	Eligible	BLM	Southern Paiute, Historic trash scatter
42KA6136	Prehistoric	Eligible	BLM	Lithic scatter
42KA6137	Prehistoric	Eligible	BLM	Lithic scatter
42KA6138	Prehistoric	Eligible	BLM	Late Archaic, Southern Paiute
42KA6139	Prehistoric	Eligible	BLM	Temporary camp
42KA6307	Prehistoric	Eligible	Private	Lithic scatter
42KA6351	Prehistoric	Eligible	BLM	Archaic lithic scatter

Table 3.4.1. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA6352	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6353	Prehistoric	Eligible	BLM	Lithic scatter
42KA6354	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6357	Prehistoric	Eligible	BLM	Archaic, Southern Paiute temporary camp
42KA6360	Prehistoric	Eligible	BLM	Archaic, Late Prehistoric lithic scatter
42KA6361	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6477	Prehistoric	Eligible	Private	Lithic scatter
42KA6478	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6479	Prehistoric	Eligible	Private	Lithic scatter
42KA6480	Prehistoric	Eligible	Private	Archaic lithic scatter
42KA6481	Prehistoric	Eligible	Private	Lithic scatter
42KA6482	Prehistoric	Eligible	Private	Lithic scatter
42KA6483	Historic	Not Eligible	Private	Camp
42KA6484	Historic	Not Eligible	Private	Dugout and corral and trash scatter
42KA6485	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6486	Prehistoric	Eligible	Private	Anasazi, Fremont
42KA6487	Historic	Not Eligible	Private	Trash scatter
42KA6488	Prehistoric	Eligible	Private	Lithic scatter
42KA6489	Historic	Not Eligible	Private	Enclosure
42KA6490	Prehistoric	Eligible	Private	Lithic scatter
42KA6491	Prehistoric	Eligible	Private	Lithic scatter
42KA6492	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6493	Prehistoric	Eligible	BLM, private	Anasazi, Protohistoric artifact scatter
42KA6494	Multicomponent	Eligible	Private	Middle Archaic, Anasazi, Protohistoric, Euro-American
42KA6495	Prehistoric	Eligible	Private	Virgin Anasazi Pueblo II rockshelter and artifact scatter
42KA6496	Prehistoric	Eligible	Private	Lithic scatter
42KA6497	Prehistoric	Eligible	Private	Archaic, protohistoric lithic scatter
42KA6498	Prehistoric	Eligible	Private	Lithic scatter
42KA6499	Multicomponent	Eligible	Private	Middle Archaic, Euro-American
42KA6500	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6501	Prehistoric	Eligible	Private	Lithic scatter
42KA6502	Prehistoric	Eligible	Private	Lithic scatter
42KA6503	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6504	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6505	Prehistoric	Eligible	Coal Hollow, private	Late Archaic, Anasazi artifact scatter

Most archaeological sites (95%) identified in the tract are prehistoric, or contain prehistoric components and consist of lithic scatters from stone tool production, use, and maintenance. Table 3.4.2 provides a summary of the general cultural association of these sites (historic, prehistoric, or both, i.e., multicomponent) and their NRHP-eligibility assessment. Most recorded sites (81%) are eligible for the NRHP and are considered significant resources in terms of their potential to yield important historic or prehistoric information.

Table 3.4.2. Summary of Archaeological Site Types in the Tract

Cultural Association	Eligible	Not Eligible	Total
Historic	0	6	6
Multicomponent	7	0	7
Prehistoric	100	19	119
Total	**107**	**25**	**132**

Many of the recorded prehistoric and multicomponent sites contain components that can be associated with individual cultural periods or phases. Table 3.4.3 presents the numbers of such cultural components (i.e., occupations that date to an individual period or phase) that have been identified at sites recorded in the tract; because more than one component can be present at a site, the total number of components listed here is greater than the total number of sites in Tables 3.4.1 and 3.4.2 above.

Table 3.4.3. Identified Prehistoric Components at Archaeological Sites Recorded in the Tract

NRHP Eligibility	Archaic	Anasazi	Fremont	Numic	Unknown	Total
Eligible	30	18	5	26	53	132
Not Eligible	1	0	0	0	18	19
Total	**31**	**18**	**5**	**26**	**71**	**151**

3.4.2.3 CULTURAL RESOURCES ALONG THE REASONABLY FORESEEABLE COAL HAUL TRANSPORTATION ROUTE

In addition to impacts to archaeological sites in the tract, impacts to cultural resources along the reasonably foreseeable coal haul transportation route under the Proposed Action (see Map 2.5) must also be analyzed. Such resources include the Panguitch Historic District, which is listed on the NRHP, and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area.

The Panguitch Historic District is roughly bordered by 500 North, 400 East, 500 South, and 300 West. The portion of the reasonably foreseeable coal haul transportation route through Panguitch that follows Center Street from 400 East to Main Street and then follows Main Street to 500 North would be in the historic district (Map 3.7). The district is significant for its association with the early settlement of Panguitch, originally an isolated pioneer outpost, and with the subsequent economic development of the area, which has focused on ranching and tourism (2006). It is also significant for its intact concentration of historic buildings, many of which are made from a characteristic, locally manufactured red brick.

The Utah Heritage Highway 89 and Mormon Pioneer Heritage Area were established by the National Heritage Areas Act of 2006 (2006). The portion of this area through which the reasonably foreseeable coal haul transportation route would pass would consist of the town of Alton, the roads that connect Alton to US-89, and the US-89 corridor to its junction with SR-20, including the communities of Hatch and Panguitch. The heritage area was established in recognition of the role that Mormon settlement played in the Euro-American colonization of the west and, among other things, in opening up "vast amounts of natural resources, including coal, uranium, silver, gold, and copper" (2006). As a legislatively established heritage area, the board of directors of the Utah Heritage Highway 89 Alliance is authorized to receive federal funds for purposes such as conserving, interpreting, and developing the historical, cultural, natural, and recreational resources in the heritage area, and expanding, fostering, and developing heritage businesses and products relating to the cultural heritage of the heritage area.

3.4.3 Native American Consultation

Initial consultation regarding the tract has taken place with the Kaibab Paiute, Southern Paiute, Hopi, Ute, Zuni, and Navajo tribes (Zweifel 2008). Cultural and religious concerns could arise among the tribes because archaeological resources have been identified in the tract. If such concerns are identified, consultation with tribes would occur. The PA developed for the Alton Coal Tract LBA instructs the BLM to continue tribal consultation, and tribes will have an opportunity to review the HPTP as part of the ongoing consultation process. Other considerations such as possible effects to TCPs will be incorporated into the HPTP, as necessary. TCPs can include, but are not limited to, natural landscape features, natural resource harvesting and processing areas, trails, and archaeological sites.

3.5 Fire Management

The analysis area for fire management is the tract and reasonably foreseeable coal haul transportation route. The *Southern Utah Support Area Fire Management Plan* (BLM 2005c) acts as the primary strategic document for fire management on and adjacent to the Alton Coal Tract. The overlying goal of the fire management plan is to describe specific actions authorized on the public lands to protect life and ensure public safety, to target resource goals and objectives, to reduce fuel loads, and to achieve and maintain healthy, functioning ecosystems (BLM 2005c). Protection of human life, including the lives of firefighters committed to an incident, is the mandated priority for all fire management activities.

In the fire management plan, land management areas are established. These areas are called fire management units (FMUs) and are defined by objectives, topographic features, access, protected values, political boundaries, fuel types, or major fire regimes. These units have dominant management objectives and have preselected fire management strategies assigned to accomplish these objectives. The tract is entirely in the Glendale Bench FMU (Map 3.8). The Glendale Bench FMU encompasses 118,618 acres, 67,423 of which are under BLM management. Approximately 2,280 acres of the FMU on the tract is on public lands.

3.5.1 Area Overview and Fire History

The tract occurs in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001b). Precipitation in the FMU averages approximately 14–18 inches of water per year, as modeled by the Parameter-elevation Regressions on Independent Slopes Model (PRISM) from 1961 to1990 (2004). Most of this precipitation is in the form of snow during the winter months. Summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (WRCC 2006).

The weather and fuel structure in the tract provide an opportunity for ignition from frequent summer storms. Lightning accounts for at least 78% of fire starts in the BLM-KFO area. Careless smoking, vehicle exhaust, escaped agricultural burning, and unattended campfires account for most human-caused fires in the Glendale Bench FMU. Sparking from vehicles or construction equipment is also responsible for starting some fires (BLM 2004). Naturally occurring fires are widely distributed in terms of frequency and severity.

Sensitive resources in the FMU that could be affected by wildfire include greater sage-grouse lekking, nesting, wintering, and brood-rearing habitat, deer and elk crucial summer ranges, the upper Kanab Creek watershed, and archeological resources. Unplanned wildfire may also affect communication sites, private residences, range improvements, special status species habitat, power lines, dispersed recreation opportunities, and ROWs (BLM 2005c).

3.5.2 Wildland-Urban Interface

Wildland fires pose the greatest threat to community residents, property, and firefighters when they occur in, or spread into, the WUI. WUIs are commonly defined as geographic areas where human habitation and developments intermix with wildland or vegetative fire (SWCA 2007b). The *Southwest Utah Regional Wildfire Protection Plan* (RWPP) does not consider the town of Alton as a state-identified community at risk of wildfire (FCAOG 2007b). However, the RWPP does identify WUI areas immediately west of Alton, along the length of US-89, as well as the Spencer Bench, Spencer Cliff Estates, and Stout Canyon area. The RWPP risk assessment identifies a high wildfire risk in these areas (FCAOG 2007b), which include portions of the reasonably foreseeable coal haul transportation route.

3.5.3 Fire Management Objectives and Planning Efforts

3.5.3.1 FIRE REGIME CONDITION CLASS

Fire regime condition class (FRCC) is an interagency, standardized tool for determining the degree of departure of an area or landscape from its historic to its present conditions (i.e., fire frequency in the area), including the effects of fire suppression and invasive species invasion. Assessing FRCC can help guide management objectives and set priorities for treatments. FRCC was assigned to classify vegetation on public lands in the state through review of cover types identified by Utah Southwest Regional Gap Analysis Project (SWReGAP) Analysis (Edwards et al. 1995) and elevation ranges (BLM 2008b). FRCCs are defined as follows:

- **FRCC 1:** Fire regimes are within a historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range. Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
- **FRCC 2:** Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components (soil, vegetation structure, species composition, alteration of nutrient cycles, hydrologic regimes) is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased), which results in moderate changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
- **FRCC 3:** Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range. Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments, before fire can be used to restore the historical fire regime.

The dominant vegetation communities in the tract area are pinyon-juniper woodland, sagebrush/grassland, and treated sagebrush/grassland (Table 3.5.1). Annual and perennial grasses (pastureland), mountain brush, meadow wetlands, riparian, and rabbitbrush vegetation communities are also found in the tract. Acreages of vegetation are presented in Table 3.5.1 and Map 3.15 and FRCC is shown on Map 3.9.

Table 3.5.1. Acreages of Vegetation and Fire Regime Conditions Class in the Fire Management Unit/Tract

Vegetation Community	Acreage	Percentage of the Tract*	FRCC
Pinyon-juniper woodland	1,430.0	40.2%	3
Sagebrush/grassland	860.2	24.1%	3
Sagebrush/grassland (treated)	749.1	20.9%	3
Annual and perennial grasses (pastureland)	324.1	9.1%	3
Mountain brush	62.8	1.8%	3

Table 3.5.1. Acreages of Vegetation and Fire Regime Conditions Class in the Fire Management Unit/Tract

Vegetation Community	Acreage	Percentage of the Tract*	FRCC
Meadow	62.8	1.8%	3
Riparian	55.3	1.5%	3
Rabbitbrush	10.7	0.3%	3
Total	**3,555.0**	**99.7%**	–

* Unvegetated areas consist of 4.1 acres of open water and 17.4 acres of roads, or approximately 0.6% of the 3,576.6-acre tract.

3.5.3.2 DESIRED WILDLAND FIRE CONDITION

Desired wildland fire condition (hereafter referred to as the desired condition) is the description of the desired condition of a vegetative community as it relates to its susceptibility from severe fire effects (e.g., the loss of key ecosystem components such as soil, vegetation structure, species; or the alteration of key ecosystem processes such as nutrient cycles and hydrologic regimes).

The general desired condition is to have ecosystems that are at a low risk of losing ecosystem components following a wildland fire and that function within their historical range. A healthy ecosystem at low risk of losing key ecosystem components following a wildland fire would be considered at optimum desired condition.

In terms of desired condition outside the WUI, the trend is to move to a lower FRCC using the least intrusive method possible. In other words, the desired condition would involve moving lands in FRCC 3 to FRCC 2 and lands in FRCC 2 to FRCC 1. When feasible, this would occur through fire and nonfire treatments where wildland fire use is the preferred method of treatment. Inside the WUI, the general desired condition is less potential for values to be threatened by wildland fire, usually through modification of fuels. Therefore, because all of the lands in the tract fall in FRCC 3, the trend would be to move them to FRCC 2.

Fire management actions authorized for wildland fire activities, prescribed fire and nonfire fuel treatments, and emergency stabilization and restoration are based on desired condition. The Utah land use plan amendment for fire and fuels management addresses specific fire management objectives for each major vegetation community, and is designed to progress toward desired condition of public lands.

3.6 Geology and Minerals

3.6.1 Regional Overview and Analysis Area

The Alton Coal Tract is part of the Alton Coal Field, which is between the Kaiparowits Coal Field to the east and the Kolob Coal Field to the west. The tract is east of Long Valley and southwest of the Paunsaugunt Plateau. The geology, geologic history, stratigraphy, and structure of the tract have been described by Doelling and Graham (1972) and Tilton (2001) and are summarized in this section, along with geologic hazards, mineral resources potentially present in or near the tract, and underground coal fires.

The geology and minerals analysis area is primarily the Alton Coal Tract under all action alternatives. However, the area north and northeast of the tract's underground mining portion, extending 405 feet beyond the tract boundaries (an area of approximately 166 acres outside the tract boundary) along its north and northeast edge, is also included. This area is within what is known as the "angle of influence" and defines the extent of the surface area affected by ground movement that occurs from removing coal from an underground mine where overlying rock layers are no longer supported by underlying coal removed during mining.

3.6.2 Local Geology

3.6.2.1 TOPOGRAPHY AND PHYSIOGRAPHY

The tract is characterized by bench and slope topography. Topographic relief in the region is approximately 3,000 feet, with elevations ranging from approximately 9,300 feet on top of the Paunsaugunt Plateau to approximately 6,500 feet in the Kanab Creek valley bottoms.

The tract is southwest of the Paunsaugunt Plateau in the Alton Amphitheater, which is typified by broad, gently rolling hills and valleys and landforms with isolated bedrock outcrops. The west portion of the tract is transected by Kanab Creek, which runs north to south. The tract also includes the Robinson Creek drainage, which runs east to west.

In 1983, OSM reported that there are potential AVFs in the Alton Coal Field. Further, a reconnaissance-level survey was conducted on the tract in spring 2008 and confirms the presence of potential AVFs in portions of the tract (see Appendix F). See Section 3.16 for more information regarding AVFs.

3.6.2.2 STRATIGRAPHY

The geologic stratigraphy of the region in and near the tract consists of Jurassic, Cretaceous, and Quaternary age deposits of (from oldest to most recent) Navajo Sandstone, Carmel Formation, Dakota Formation, Tropic Shale, Straight Cliffs Formation, Wahweap and Kaiparowits formations, Claron Formation, and Quaternary deposits (see Figure 3.6.1 for a stratigraphic cross section of the area). The stratigraphy in and immediately adjacent to the tract includes the Dakota Formation, the Tropic Shale, the Straight Cliffs Formation, and various Quaternary deposits. In the Dakota Formation, two regionally important coal zones are present. These include the Smirl Coal Zone, which is near the upper formational contact with the Tropic Shale, and the Bald Knoll Coal Zone, which is approximately 200 feet below the Smirl Coal Zone near the base of the Dakota Formation (see Figure 3.6.1). The Bald Knoll Coal Zone is not of interest in this analysis because it would not be mined and, therefore, it is not further discussed.

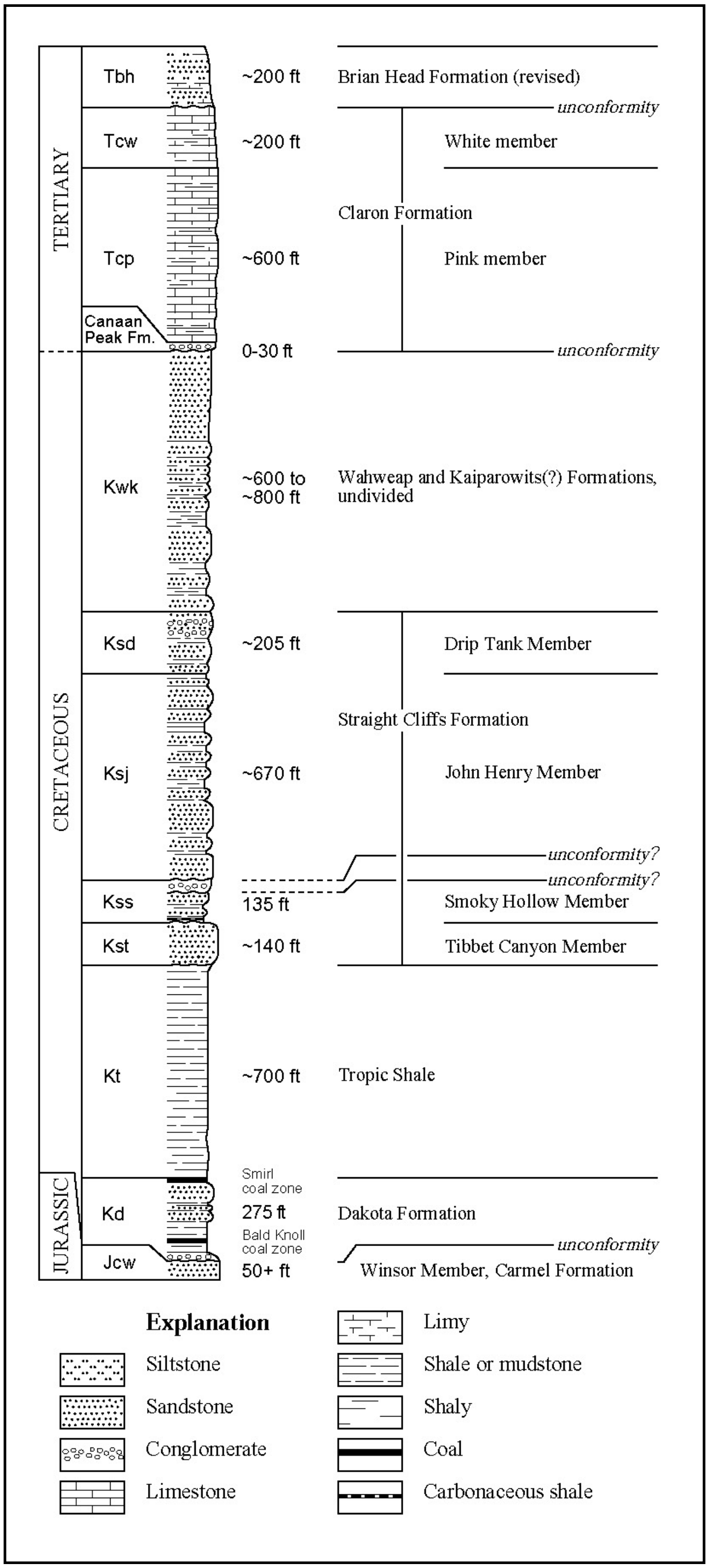

Figure 3.6.1a. Stratigraphic cross section of the stratigraphy in western Kane County (Part 1 of 2). (Tilton 2001)

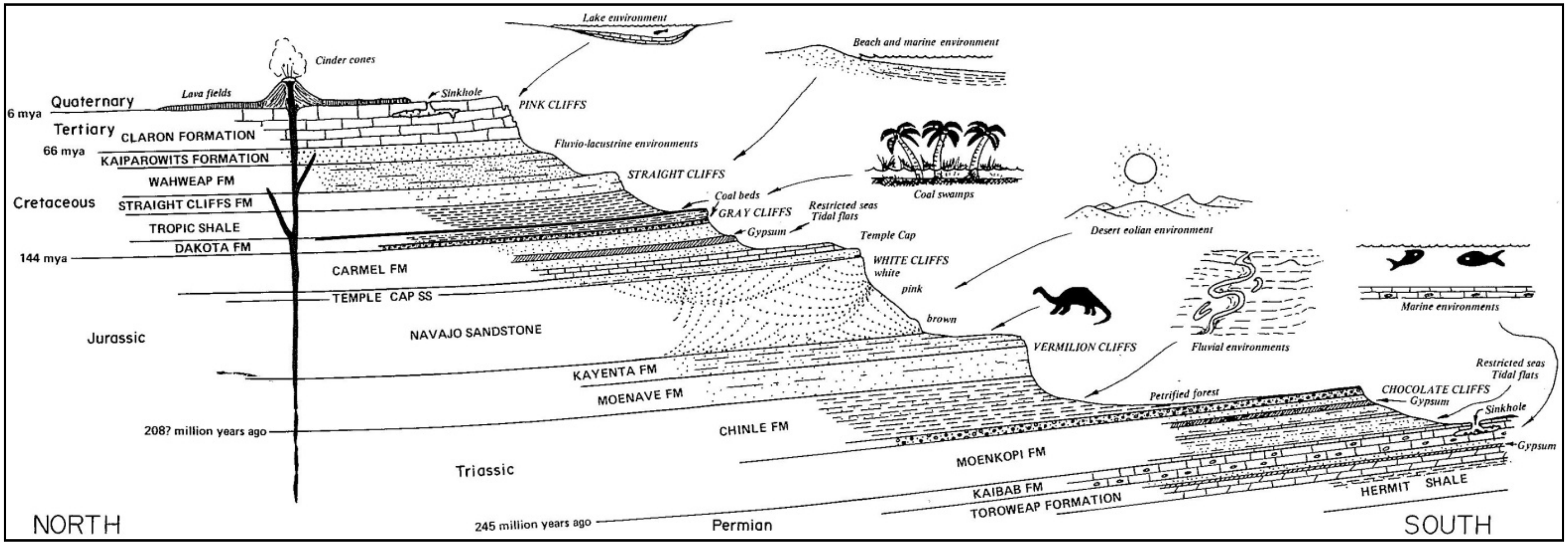

Figure 3.6.1b. Stratigraphic cross section of the stratigraphy in western Kane County (Part 2 of 2). (Doelling et al. 1989)

The degree of exposure of these formations depends primarily on the amount of weathering and erosion that has resulted in changes to the physical geology of the area over geologic time. The results of these geologic processes for the area are shown in Map 3.10. The Dakota Formation and Tropic Shale dominate the geology of the tract.

In areas where it has not been weathered or eroded, the Dakota Formation has a maximum thickness of approximately 275 feet. The Dakota Formation consists of alternating mudstone and sandstone layers with associated coal, bentonite, and conglomerate. The physical character and makeup of the Dakota Formation suggests marine and nonmarine depositions, including shallow subtidal, shoreface, distal coastal plain, and stream channel components. The Dakota Formation is a poor source of producible water because of its intricate interlayering, lensing, and interfingering of permeable and impermeable beds.

In areas where it has not been weathered or eroded, the Tropic Shale marine unit has a maximum thickness of approximately 700 feet. Marine fauna are locally visible, including ammonites and oysters. See Section 3.10 for more information on fossil resources in the area. In the tract, the Tropic Shale has mostly weathered and eroded to where the thickness ranges from zero to tens of feet. The Tropic Shale consists predominantly of gray and carbonaceous silty shale and claystone with a few marine sandstone beds mostly in its upper layer. The Tropic Shale typically weathers at the surface to a clayey soil that forms gentle slopes. The Tropic Shale acts as an impermeable layer that does not yield significant water or transmit significant water to the Dakota Formation (ACD 2008). Springs form in areas where the sandstone of the Straight Cliffs Formation or pediment gravel overlay the Tropic Shale (UII 1987b).

The Straight Cliffs Formation has four members. Immediately adjacent and north-northeast of the tract, these members have eroded. The Straight Cliffs Formation has been downdropped on the east side of the Bald Knoll Fault, creating the steep hillsides that border the east and northeast tract boundaries. The members consist primarily of sandstone and mudstone—with sandstone composing approximately 75% of the total composition—and erode to form cliffs and steep slopes above the Tropic Shale.

There are many delineated units of the Quaternary system. The units that are exposed in the tract consist of alluvium and landslide deposits. Alluvium fills the Kanab Creek, Robinson Creek, and other minor drainages. The alluvium, therefore, transects the entire north to south tract boundaries and expands to varying widths from the east to west tract boundaries. The alluvium ranges from 0 to 50 feet thick, but is up to 140 feet thick along the eastern margins of Sink Valley outside the tract (1979).

The landslide unit is along the northeast perimeter of the tract. It is characterized by unconsolidated knolls with deposits of mud and sand, and large blocks of sandstone. This unit is formed primarily from gravity-transported slide debris of the Straight Cliffs Formation and is less than or equal to 100 feet thick. AVFs are discussed in the water resources section.

The pediment gravel deposits are typically on gentle hills formed on the Tropic Shale. The gravels are poorly sorted and composed of cobbles and pebbles from the Canaan Peak and Claron formations.

3.6.3 Geologic Hazards

3.6.3.1 FAULTS

There are two major fault zones near the tract: the Sevier fault zone 1–2 miles west of the tract and the Paunsaugunt fault zone approximately 15 miles east of the tract. Both of these fault zones generally trend to the northeast and are considered normal faults with the downdropped block on the west. Displacements along the Sevier fault zone are approximately 1,000–2,000 feet, and along the Paunsaugunt fault zone, displacements are 100–800 feet (Doelling et al. 1989).

Three smaller, generally north-south-trending local faults occur between the Sevier and Paunsaugunt fault zones: Sink Valley Fault, Bald Knoll Fault, and Sand Pass Fault. The Sink Valley Fault runs parallel and along the southeast boundary of the tract with displacements on the order of tens of feet. The Bald Knoll Fault is 1.5–2.0 miles east of the tract, and the Sand Pass Fault is 2.0–3.0 miles west of the tract, each with less than 650 feet of displacement.

Seismic activity reports from two University of Utah seismograph stations in the region (Kanab and East Kanab) show that the region has not experienced significant, recent seismic activity. In the last few years there have been clusters of earthquake activity with magnitudes up to approximately 3.6 on the Richter Scale (Arabasz et al. 2006; University of Utah 2008).

The region surrounding the tract is on the edge of the intermountain seismic belt (Pechmann 2008). According to the USGS National Seismic Hazard Maps (2008), the region has a 2% probability of exceeding a peak horizontal acceleration of between 20% and 30% due to gravity. This is not a negligible or a high level of seismic hazard compared to other areas in Utah (such as the Wasatch Front), but it is above the 10% of gravity that is often assumed to be the threshold for damage to weak construction, such as unreinforced masonry buildings (Pechmann 2008). The coal mining process often induces seismic events due to subsidence and forces due to the removal of coal and overburden. However, the National Seismic Hazard Maps do not include mining-induced seismicity in their hazard ratings.

3.6.3.2 ACID-FORMING AND TOXIC-FORMING MATERIALS

Typical acid-forming materials in western coal mine environments consist of inorganic sulfide minerals, including pyrite and marcasite. Exposure to air and water may oxidize sulfur-bound compounds, causing the release of hydrogen (H+) ions in water, thus decreasing pH (creating acidic conditions). UII and ACD conducted geochemical analysis in the area in 1987 (1987b) and 2007–2008 (2008), respectively. The results from both surveys indicate that the acidic-forming potential is low for the tract because 1) the concentration of sulfur species is low, 2) the concentration of naturally neutralizing calcium carbonate is high, and 3) most of the sulfur species present are organic based, and therefore do not typically contribute to forming acidic conditions. USGS reports low levels of mercury, thorium, and uranium within Alton coals, but reports these levels to be of low concern (Bowers et al. 1976).

Selenium was not detected in any of the samples from the adjacent Coal Hollow Mine permit area, and concentrations of water-extractable boron were low (i.e., less than 3 milligrams (mg)/kg in all samples analyzed). Based on the geochemical analyses referenced above, acid-forming and toxic-forming materials that could result in the contamination of surface-water or groundwater supplies in the tract are generally not present (Petersen Hydrologic 2007).

Acid-forming and toxic-forming materials are not expected to represent a geologic or mineral hazard under the Proposed Action and will not be carried forward for detailed analysis in Chapter 4.

3.6.3.3 RADON

Radiation, as found in radon gas, comes from the natural (radioactive) breakdown of uranium in soil, rock, and water. ACD (2008) conducted a radon survey and showed no hazardous concentrations of radon in the adjacent Coal Hollow Mine permit area. Furthermore, Doelling et al. (1989: Plate 5) showed that the tract area did not have areas of “above background radiation” or uranium deposits.

The drill hole analysis completed by Applied Geotechnical Engineering Consultants (2007) for the adjacent Coal Hollow Mine indicates that there is no significant radon gas present in the Smirl Coal Zone in that location (Applied Geotechnical Engineering Consultants 2007). Assuming that the Smirl Coal

Zone within the Alton Coal Tract is similar to this zone within the Coal Hollow Mine area, no geologic hazard from radon is anticipated to occur under the Proposed Action because no unusual concentrations would be intercepted or released by mining activities on the tract. In addition, the surface mine would be naturally ventilated ("open air") during the mining process and any underground mining would also be ventilated according to DOGM and MSHA regulations and procedures. Therefore, radon is not carried forward for detailed analysis in Chapter 4.

3.6.3.4 LANDSLIDE

Quaternary landslide deposits composed of mud, sand, and blocks of sandstone are present in and adjacent to the tract (see Map 3.10). One area of landslide deposits is present east of the tract below the Straight Cliffs Formation. The thickness of the landslide deposits locally ranges from a few feet to more than 100 feet. The landslide deposits generally sustain more plant growth (usually oaks) than the surrounding undisturbed land because of the deposits ability to hold water (Tilton 2001).

3.6.4 Mineral Resources

3.6.4.1 LEASABLE MINERALS

3.6.4.1.1 Coal

The tract is in the Alton Coal Field. The tract contains approximately 46 million tons of recoverable coal in the Dakota Formation. The coal that would be mined is present as a single coal seam approximately 15 feet thick, referred to as the Smirl Coal Zone. Overburden above the Smirl Coal Zone ranges from 20 to 300 feet thick with an average thickness of 100 feet. It is composed primarily of Tropic Shale and Quaternary deposits (both described above).

The average quality of the coal in the Smirl Coal Zone is summarized in Table 3.6.1. The inherent moisture content of the coal is approximately 13%. Higher percentages of moisture lower the heating efficiency of coal. Ash content of coal is the noncombustible residue left after coal is burnt. The percentage of ash in the original weight for coal in the tract is approximately 10%. The fixed carbon percentage for the coal is approximately 50%, which is nonvolatile carbon minus ash. The volatile matter in coal refers to the components of coal, other than moisture, that are liberated at high temperatures in the absence of air. The fixed carbon content of the coal is the carbon found in the material that is left after volatile materials are driven off. These compounds include long-chain and aromatic hydrocarbons. The percentage of volatile matter of this coal is approximately 39%. The sulfur content of the coal is approximately 1.13%, which is lower than the average of 2%–3% for this type of coal (high-volatile subbituminous B). The lower the sulfur content is in coal, the less sulfur is emitted into the air during the burning of coal, and hence, the less sulfuric acid is formed. The coal in the Smirl Coal Zone has a heat content approximately 20 million British thermal units (BTU) per ton (10,019 BTUs per pound).

Table 3.6.1. Average Quality of the Coal in the Smirl Coal Zone

Thickness (feet)	Moisture (%)	Ash (%)	Fixed Carbon (%)	Volatile Matter (%)	Sulfur (%)	BTU/ton
15.3	13	10	50	39	1.13	~ 20 million (10,019 BTUs/pound)

Source: ACD (2004).

3.6.4.1.2 Oil and Gas

There is an oil and gas lease (UTU-079271) that includes the northeast area of the tract and extends to the area north and east of the tract (east of the Sink Valley Fault where the Straight Cliff Formation is exposed; see Map 3.10). In general, the BLM classifies this area as high potential for oil and gas development (2008b), and there are a handful of existing leases near the tract. Given the coal deposits (both the Smirl Coal Zone and the Bald Knoll Coal Zone) in the area, there is also a potential for the occurrence of coalbed CH_4; though there are no existing proposals to develop this resource.

3.6.4.2 SALABLE MINERALS

3.6.4.2.1 Burnt Shale

The geological map for the tract shows three gravel resource sites (see Map 3.10), which are in Sections 13, 24, and 31, Township 30 South, Range 6 West. The BLM-KFO reports that these are authorized community pits that are open to the public for purchase of burnt shale aggregate. Most of these pits have been in operation since the late 1970s and are nearly depleted. Other known burnt shale resources exist west of the tract. Recent interest in the development of these resources has been shown.

3.6.4.2.2 Gravel

As mentioned in the stratigraphy section above, there are pediment gravels in the tract. These gravel deposits are derived mostly from the erosion of the Claron and Canaan Peak formations and consist of quartzite pebbles and cobbles. These deposits are considered to be salable by the BLM.

3.6.4.3 LOCATABLE MINERALS

3.6.4.3.1 Septarian Nodules

Septarian nodules are geode-like concretions containing angular cavities or cracks, or septaria. The nodules are often valued by collectors, and occur in the Tropic Shale near the tract. The nodules in the region are thought to be of high (gem) quality, and are considered a locatable resource.

According to the *Kanab Field Office RMP/EIS Final Analysis of the Management Situation,* active mining for septarian nodules is occurring on leases in the Mount Carmel area southwest of the tract (BLM 2005b). Development potential is rated moderate in areas where Tropic Shale is present, as in the Alton tract (BLM 2005b). However, because no surveys or studies have been done on the tract for septarian nodules, it is unknown how common these nodules are in the tract, or if they are present in sufficient density to be economically viable for development.

3.6.5 Underground Coal Fires

According to (Stracher 2007) spontaneous combustion is the most significant cause of fires in coal mines. An increase in the temperature of coal occurs when the coal is exposed to air. A reaction occurs between the coal and the air in a solid-gas process that involves the reaction of oxygen. Provided there is an adequate supply of oxygen, a process called *runaway ignition* can occur. Runaway ignition is when the heat raises the temperature of the coal, which changes the rate of oxidation. If unchecked, this process can grow exponentially and subsequently initiate a fire. If the generated heat is quickly dissipated, the risk of spontaneous combustion decreases.

Coals of lower BTU rank are more susceptible to spontaneous combustion than coals of higher rank. The coal in the Alton Coal Tract has an average of 10,019 BTUs per pound, which is lower than other coal fields in Utah (Jahanbani 1998). Even higher rank, eastern coals have ignited either by spontaneous combustion or other sources once exposed to atmospheric oxygen.

Coal ignitions due to spontaneous combustion in surface mines or surface coal stockpiles do occur but are readily accessible and manageable. Mine operators have financial and environmental incentives to quickly and effectively control any ignitions that may occur in surface mines or surface coal stockpiles. However, underground fires near surface coal mines have proven to be troublesome because the fires generally cannot be controlled or extinguished. This is a particular problem in the eastern United States where higher population density means towns and structures can be, and have been, directly affected because the towns are directly above the coal seams.

Underground coal fires can also be attributed to mine-related activities such as cutting and welding, electric work, use of explosives, smoking, or any activity that could provide ignition. Other activities that do not provide a spark but can increase the risk for spontaneous combustion include the movement of heavy machinery and vehicles that have the potential to create fractures in the coal seam, which leads to increased oxygen circulation. In addition, fires can be caused after abandonment of the mine when humans provide ignition of the coal through other means.

A historical review of the coal history prepared by Doelling and Graham (1972) and site visits have not shown any indication of past coal mine fires near the tract. Also, past mining of the Smirl Coal Zone in the tract and surrounding areas has occurred at very shallow depths, with more exposure of the coal to atmospheric oxygen.

3.7 Hazardous Materials and Hazardous and Solid Waste

3.7.1 Existing Sources of Hazardous Materials and Hazardous and Solid Waste On and Adjacent to the Tract

The analysis area for hazardous materials and hazardous and solid waste is the tract and the reasonably foreseeable coal haul transportation route. Hazardous materials are defined as any material that may pose a hazard to human health or the environment, because of its quantity, concentration, or physical or chemical characteristics. Hazardous materials include flammable or combustible material, toxic material, corrosive material, oxidizers, aerosols, and compressed gases. Solid waste includes garbage; construction debris; commercial refuse; sludge from water supply or waste treatment plants, or air pollution control facilities; and other discarded materials. Hazardous materials discussed in this section include hazardous chemicals, hazardous substances, and hazardous wastes, and are defined below according to the EPA (2010).

- Hazardous chemical: An EPA designation for any hazardous material requiring a Material Safety Data Sheet (MSDS) under OSHA's Hazard Communication Standard. Such substances are capable of producing fires and explosions or adverse health effects like cancer and dermatitis.
- Hazardous substance: Any material that poses a threat to human health and/or the environment. Any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or is otherwise released into the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive.
- Hazardous waste: Byproducts of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or appears on special EPA lists.

Coal mining and subsequent transportation activities would necessitate the presence of hazardous materials at the Alton Coal Tract. Primarily, these materials would include fuels, lubricants, and solvents. See Section 2.3.2.7 for a list of hazardous materials anticipated for the tract. Potential sources of hazardous or solid waste on the tract would include hazardous substances, petroleum products, and/or solid waste associated with coal mining and transportation activities. Currently there are no hazardous materials or solid wastes present on the tract.

3.8 Land Use and Access

3.8.1 Land Status and Ownership

The analysis area for land use and access is the tract. Primary land uses in and adjacent to the Alton Coal Tract include tourism, farming, livestock grazing, and dispersed recreation, including hunting. See Sections 3.9 Livestock Grazing and 3.11 Recreation for details on these specific land uses. The *Kane County, Utah General Plan* describes the area as, "some of the most remote and rugged lands in the continental United States" (FCAOG 2011). The plan has not allowed for significant development in the area. There are no commercial buildings, facilities, or private residences within the tract. However, the nearest residential community is the town of Alton, whose population is approximately 140 (UDWS 2010). Alton is immediately north of the northern tract boundary. There are no state lands in or immediately adjacent to the tract. The closest parcel of SITLA land is 1 mile northwest of the tract. Map 1.1 illustrates the location of the tract in relation to some of the private and federal land ownerships in the area.

Access to the tract is from US-89, approximately 2.9 miles west of the tract. This highway is the major thoroughfare for the area, serving as a route for tourist traffic to public lands, including Bryce Canyon National Park, Dixie National Forest, BLM-managed lands, and Grand Staircase-Escalante National Monument. For details regarding transportation along portions of US-89, refer to Section 3.14 Transportation and Appendix H.

3.8.1.1 PRIVATE LANDS AND EXISTING LAND USES ON AND ADJACENT TO THE TRACT

All coal reserves within the tract are federally owned, though surface ownership is mixed. Approximately 1,296 surface acres of the tract are in private ownership, including eight different private surface owners. Landowners have been notified of the tract and will be included throughout the EIS process. Private land uses in the tract and surrounding land include farming, livestock grazing, and dispersed recreation, including hunting. Land use specifically in Alton has traditionally been for homes, farming, and livestock grazing. There have not been any official classifications of land use or zoning ordinances to enforce the use of land; however, the land has been generally classified into four areas: residential, church, agriculture, and recreation (FCAOG 1981). Two-track roads also exist throughout the tract for recreational use and for private landowner access to private surface lands.

3.8.1.2 FEDERAL LANDS AND EXISTING LAND USES ON AND ADJACENT TO THE TRACT

The BLM-KFO consists of 2,847,200 acres, of which the BLM manages approximately 554,000 acres (approximately 20%). All coal reserves within the tract are federally owned. Approximately 2,280 surface acres of the tract are in federal (BLM) ownership, representing 0.4% of the total area managed by BLM-KFO. Dominant land uses in the tract include livestock grazing and recreation (primarily backcountry motorized travel and sightseeing, OHV use, and hunting).

3.8.2 Land Use Planning and Management

3.8.2.1 FEDERAL

Land use planning for public lands in the area allocates the land to many uses, including mining, grazing, and recreation (BLM 2008b). No coal production has occurred in Kane or Garfield counties since 1971, and there are presently no coal leases in the boundaries of the BLM-KFO (BLM 2008b).

Dixie National Forest lands near the tract are managed for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, and viewing nature, wildlife, and geologic features. Currently the forest is being managed under the forest plan that was signed in 1986. Revisions to the forest plan are currently on hold.

As discussed in Chapter 1, some of the coal reserves in the tract are not currently considered recoverable because KFO Route 116 traverses the tract. Under SMCRA, the approval of surface-mining operations on lands within 100 feet of the outside line of the ROW for a public road requires a process resulting in a final decision by DOGM or the public road authority. In the event of a lease sale, Kane County and the BLM would temporarily relocate KFO Route 116 during the life of the mine. Once mining operations are complete, the temporary road location would be reclaimed, and the original route would be reconstructed according to requirements specified in R645-103-234–R645-103-234.400 for relocation of public roads.

3.8.2.2 LOCAL

The entire tract lies within the northwest section of Kane County. Approximately 85% of Kane County lies in federal ownership (FCAOG 2011). Historically, Kane County lands have been used for agriculture (predominantly livestock grazing and some farming), and according to the *Kane County, Utah General Plan* (FCAOG 2011), much of the land within and adjacent to the tract is currently zoned for agricultural use.

Garfield and Iron counties are adjacent to Kane County to the north and west, respectively. These counties include areas for tourism and recreation. It is anticipated that coal mined from the tract would be transported through these counties for delivery to market (see Section 2.6.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route). Further, public travel is frequent through these counties, specifically to access federal lands near the tract (Bryce Canyon National Park, Dixie National Forest, BLM-administered lands, and Grand Staircase-Escalante National Monument). Both the Kane County and Garfield County general plans identify transportation infrastructure as an important investment due to their contribution to tourism travel in the area. The Garfield County plan indicates that the roads in the area are in fair condition partly due to insufficient funds to properly maintain and renovate them. For a detailed description of travel and transportation in the area please see Section 3.14 Transportation and Appendix H.

The town of Alton is a rural/agricultural area. Agricultural uses (i.e., animals, gardening, and farming) are permitted on residential lots, with reasonable limitations provided. Future areas of growth will be planned to minimize impact on community resources and to be consistent with the best use of the land surrounding Alton (FCAOG 1981).

3.9 Livestock Grazing

3.9.1 Regional Overview

The analysis area for livestock grazing is the tract, reasonably foreseeable coal haul transportation route, and the area immediately adjacent to the tract and transportation route, because the potential impacts to the vegetation that livestock rely on are not expected to extend beyond this area. Grazing in the Alton Coal Tract is administered by the BLM in accordance with the *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). These standards and guidelines were instituted for all Utah rangelands and are based on ecological principles that underlie the sustainable production of rangeland resources. With regard to rangeland health, the following four conditions must be present on BLM-administered public lands:

- Watersheds are in, or are making significant progress toward, properly functioning physical condition, including their upland, riparian-wetland, and aquatic components; soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform and maintain or improve water quality, and timing and duration of flow.
- Ecological processes, including the hydrologic cycle nutrient cycle, and energy flow, are maintained, or there is significant progress toward their attainment, in order to support healthy biotic populations and communities.
- Water quality complies with state water quality standards and achieves, or is making significant progress toward achieving established BLM management objectives such as meeting wildlife needs.
- Habitats are, or are making significant progress toward being, restored or maintained for federal threatened and endangered species, federal proposed, Category 1 and 2 federal candidate and other special status species. (BLM 2007)

Section 3 of the Taylor Grazing Act of 1934, as amended, authorizes livestock grazing on BLM-administered public lands.

3.9.2 Allotments on and Adjacent to the Tract

Seven grazing allotments encompass 2,143 acres of the tract (Table 3.9.1; Map 3.11); two occur completely within the tract and five occur partially within the tract. The Alton and Cove (Alton) allotments occur completely within the tract. The allotments that occur partially within the tract are the Isolated Tracts, Levanger Lakes, Robinson Creek, Syler Knoll, and Upper Sink Valley allotments. These allotments are used exclusively for cattle grazing; they are not used to graze horses or sheep (BLM 2008a).

Table 3.9.1. Grazing Allotment Acres and Animal Unit Months (AUMs) in the Alton Coal Tract

Allotment	Total Federal Acres	Acres Within the Tract*	Percentage of Allotment in the Tract†	Total AUMs Allocated to Livestock	Calculated AUMs in Tract‡
Alton	392	388.5	99%	5	5
Cove (Alton)	158	155.9	99%	10	10
Isolated Tracts	1,028	243.9	24%	65	15
Levanger Lakes	872	196.3	23%	33	7
Robinson Creek	524	208	40%	24	10
Syler Knoll	442	363.5	82%	6	5
Upper Sink Valley	4,806	586.7	12%	311	38
Total	**8,222**	**2,143**	**26%**	**454**	**118**

* Acres are approximations subject to up to 5 acres of error as a result of potential misalignment of datasets at different scales.
† Percentage of each allotment in the tract has been rounded to the nearest whole number.
‡ Calculated by multiplying the total AUMs allocated to livestock by the percentage of the allotment in the tract.

The carrying capacity of a livestock grazing allotment is defined in terms of AUMs. In general terms, an AUM is the amount of forage needed to sustain one cow and her calf for one month. In specific terms, an AUM is a standardized measurement of the amount of forage necessary to sustain one cow unit (or its equivalent) for one month (approximately 800 pounds of usable air-dried forage), or the amount of forage necessary to sustain one 1,000-pound animal for one month.

Table 3.9.1 shows the total acres and percentage for each allotment that occurs partially or completely within the tract. The table also includes the total AUMs that are allocated to livestock in each allotment, and the calculated number of AUMs within the tract. The number of AUMs in the tract was calculated by multiplying the total AUMs allocated to livestock within the allotment by the percentage of the allotment within the tract. Calculated AUMs in the tract may or may not be properly represented because the AUMs in these allotments are typically found in concentrated areas due to the pinyon-juniper encroachment. As pinyon-junipers encroach into shrub-steppe vegetation communities and outcompete forbs, grasses, and shrubs for resources, fewer acres of high quality forage are available for livestock consumption within allotments. However, because the rate and extent of juniper encroachment across allotments over the life of the tract cannot be determined, it is conservatively assumed that AUMs (forage) are evenly distributed throughout the allotments.

Livestock grazing also occurs at various locations along the reasonably foreseeable coal haul transportation route. Vegetation used as forage for livestock within a 100-foot buffer of the reasonably foreseeable coal haul transportation route is affected by current vehicle traffic along this route. Road dust and vehicle exhaust inhibit stomatal function and photosynthesis (Hirano et al. 1995), and therefore impact overall plant health.

3.10 Paleontology

The analysis area for potential impacts to paleontological resources is the tract. The Alton Amphitheatre is below the west rim of the Paunsaugunt Plateau, immediately east of the Sevier fault zone. In general, the geological column in this portion of the Colorado Plateau (Foster et al. 2001) is highly fossiliferous in the Upper Triassic (Chinle Formation), Lower and Middle Jurassic (Moenave, Kayenta, and Carmel formations), and Upper Cretaceous (Dakota, Tropic, Straight Cliffs, Wahweap, and Kaiparowits formations). The tract would be primarily in the Tropic Shale (53.5%), Dakota Formation (20.3%) and Alluvium (21.2%); the remaining 5% would be in landslide deposits or areas where no data are available. Uppermost Cretaceous and Paleogene units (Canaan Peak, Pine Hollow, Grand Castle and Claron formations) are only sparsely fossiliferous due to the high energy or highly destructive weathering conditions that pervaded for most of that time. The fossil record of these units, whether highly or sparsely fossiliferous, is highly significant, and several of the formations, including the Chinle, Moenave, Wahweap and Kaiparowits formations, are justifiably famous for their vertebrate fossil fauna. The geological column in the area records a succession of semiarid to arid terrestrial environments, with intertonguing, shallow marine units in the early and middle Mesozoic, tropical, humid coastal plain conditions in the Late Cretaceous (Eaton 1991; Titus et al. 2005), and low elevation, intermontane basins during the latest Cretaceous and Paleogene. The fossil faunas and floras reflect this succession, and the tropical humid coastal plain deposits contain the highest fossil biomass. Recent work in the Kaiparowits Basin immediately to the east has demonstrated that the Alton Amphitheater contains one of the most complete Late Cretaceous (73–100 million years ago) terrestrial fossil records known in the world (Eaton et al. 1999). Surveys in the sparsely vegetated badlands of the central and southern Kaiparowits Plateau have uncovered the remains of dozens of new species of marine reptiles, dinosaurs, mammals, crocodylians, turtles, lizards, fish, and other taxa (Eaton et al. 1999; Gates 2004; Nydam 1999; Titus et al. 2005) making this resource world class. Paleontological resources in the Dakota and Tropic Shale formations are highly fossiliferous, consisting mainly of well-known invertebrate fossils such as gastropods and cephalopods. Located only 35 miles to the west, the greater Alton area holds potential for similar, significant Late Cretaceous fossil resources.

3.10.1 Paleontological Resources

The Alton Amphitheatre is underlain entirely by Late Cretaceous-age through Eocene-age sedimentary bedrock (Tilton 2001). In ascending order, these are the Dakota (target formation for coal mining), Tropic, Straight Cliffs, Wahweap, and Claron formations. A review of the Proposed Action in Chapter 2 shows that only the Dakota Sandstone and the Tropic Shale would be significantly impacted by the installation, operation, and maintenance of the mine. Both of these units have produced significant fossils in the immediate area near the town of Alton. The Dakota Formation yields an abundant and diverse lower and middle, Cenomanian terrestrial vertebrate fauna, of which only the mammals have been described (Eaton 1993, 1995). Many of the specimens reported in these papers were recovered from the Alton Amphitheatre or immediately nearby, and clearly support the resource potential of the Dakota Formation. Fish, turtles, crocodylians, squamates, and dinosaurs are also known to occur in the Dakota Formation. The Tropic Shale similarly yields a robust, highly significant vertebrate fauna (Albright et al. 2002, 2007a, 2007b; Gillette et al. 2001). However, most of what is known about the formation has been gleaned from the Kaiparowits Plateau. Two partial plesiosaurs have been recovered near the town of Alton, one in the Ford Pasture area approximately 15 km southeast of Alton (Titus 2004, 2005) and one in the Muddy Creek septarian mine approximately 20 km southwest of Alton (Gillette et al. 1999). A third isolated paddle bone, probably a humerus, was observed west of Trail Canyon (Titus 2004, 2005); it was not collected. In addition to the marine fauna, the partial remains of an ornithischian dinosaur were collected from the Tropic Shale in the area of Muddy Creek, east and south of the tract.

Field inventories conducted in 2004 and 2005 by the BLM found the Tropic Shale in the area around the south margin of the tract to be highly fossiliferous (Titus 2004, 2005). Unusual features were noted and consist of rare, articulated fish remains and the existence of limestone mounds that may represent cold CH_4 seeps active in the Cretaceous (sourced from the Smirl Coal Zone). Upper Cenomanian ammonites and other invertebrates of the *Euomphaloceras septemseriatum*, *Eumophaloceras costatum*, *Burroceras irregulare*, and *Neocardioceras juddi* ammonoid biozones are locally common and exceptionally well preserved in three dimensions inside of limestone concretions that weather out of the shale. The ammonoid taxa found in the Alton area are considered significant because three-dimensional, well preserved specimens are rarely found in stratigraphically younger, ammonoid biozones of North America, such as the biozones present in the Alton area. In spite of the quality and abundance of fossil specimens that occur in the Tropic Shale in the Alton area, exposures of the formation are generally poor; soil and plant cover is extensive; and colluvium from the overlying Straight Cliffs and Grand Castle formations forms debris fans over much of the formation's areal extent. Therefore, the likelihood of discovering one of these limestone concretions before they have been damaged, altered or destroyed by natural processes is relatively low. Based on nearby areas where the Dakota Formation and the Tropic Shale are better exposed, the following resource occurrence patterns can be expected out of the Dakota Formation:

- The lower gravely member of the Dakota Formation is mostly barren of fossils except for reworked specimens of large, petrified conifer logs (probably sourced from the Morrison or Chinle formations) and Paleozoic invertebrate fossils in clasts derived from the Sevier Thrust Belt. These are not of any particular scientific significance and would not require mitigation, although local petrified wood collectors do value the wood as a hobby material.
- The middle member of the Dakota Formation contains common plant, invertebrate, and vertebrate fossils. The distribution of the vertebrate fossils, which are the most significant from a protection perspective, is random and uncommon in overbank pond mudstone and less random and more concentrated in the basal layers of sandstone channel deposits. Large sections of turtle shells, bivalve and gastropod concentrations, ganoid fish scales, and scattered crocodylian teeth and bones are the most obvious remains in such channel deposits. However, bulk sampling and careful study of the resulting concentrates show a much more diverse fauna that includes dinosaur, lizard, and mammalian remains.
- The upper member of the Dakota Formation is abundantly fossiliferous; however, the fauna is dominantly nearshore marine and aquatic in nature. The vertebrate fauna is dominated by isolated shark teeth and poorly preserved, boney fish remains. Plant fossils associated with the Smirl Coal Zone have been observed to be very well preserved in the Skutumpah Creek area, and potential for well-preserved vertebrates and soft bodied invertebrates in the coal zone is high even though no Konservat-Lagerstatte-type preservation has been previously observed in the Alton area.

The Tropic Shale is not formally divided into members, but it can informally be divided into three zones (intervals) in the Alton area, a lower siderite dominated interval, a middle highly fossiliferous carbonate concretionary interval, and an upper, poorly fossiliferous concretionary interval. They are as follows:

- The lower interval is approximately 7–8 m thick and immediately overlies the Smirl Coal Zone. Although fossiliferous, this lower interval has not yielded anything but poorly preserved ammonites and bivalves of the *Vascoceras diartianum* ammonoid biozone. Large specimens of the heavily ribbed ammonite *Calycoceras naviculare* are not uncommon, but they are nearly all crushed.

- The middle interval is characterized by calcite concretions 0.3–0.5 m in diameter and contain an abundant and well preserved benthic and nektic fauna. Ammonites and other mollusks are the dominant fauna, but crustaceans, corals, annelids, shark teeth, bony fish remains, and marine reptile skeletons also occur. Ammonites of the *Euomphaloceras septemseriatum* biozone (next zone above that of *V. diartianum*) are widespread and well preserved over much of North America. Although this zone's ammonites, including *Metoicoceras geslinianum*, *Sciponoceras gracile*, *Worthoceras vermiculum*, *Placenticeras cumminsi*, and *Eumophaloceras septemseriatum*, are common and very well preserved in the Alton area, they have no special scientific value outside of the local region. Hobby collectors do place great value on these fossils as objects of aesthetic beauty and wonder.
- The upper interval is characterized by three-dimensional ammonite fossils from the zones above the *E. septemseriatum* (middle) interval that are generally uncommon in North America, being well known from only a handful of places. Just south of the tract, on the east side of the Sink Valley, three-dimensional specimens of ammonites from the *Euomphaloceras costatum*, *Euomphaloceras* n. sp., *Burroceras irregulare*, and *Neocardioceras juddi* Ammonoid Biozones were collected in succession (Titus 2002). This is a very rare occurrence and is one of only three places in North America where this can be observed. It is thought that the presence of unusually high levels of coal-sourced CH_4 in the sediment during the fossilization process may have helped catalyze the excellent preservation of this succession (Titus 2002). Vertebrates are not particularly common in this interval. However, perfectly preserved three-dimensional fish fossils in this interval have been collected from the *Euomphaloceras costatum* zone in the Ford Pasture area of the BLM-KFO. The overlying Turonian sediments contain concretions, but these are generally poorly fossiliferous or contain poorly preserved fossils. To the east, this interval has the highest potential for marine reptiles. Unfortunately, there are not enough data to model their abundance in the Alton area even though their presence is certain given the finds at Muddy Creek and Ford Pasture. Higher levels in the Tropic Shale and Straight Cliffs Formation are fossiliferous but would not be impacted by activities outlined in the Proposed Action or alternatives and therefore are not reviewed.

Potential also exists for Late Pleistocene fossil resources in older alluvial and/or pluvial deposits; however, there are no good age constraints on alluvial fill in the Alton Sink and therefore no way to accurately assess potential. A similar setting near Skutumpah Creek, approximately 15 km to the southeast, yielded a partial proboscidean skeleton (cf. *Mammuthus columbi*) that was excavated by the Museum of Northern Arizona; therefore, it is likely that the floors on the alluvial fill are old enough to contain pre-Holocene vertebrate megafauna.

3.11 Recreation

Southwest Utah offers a variety of recreation opportunities in varying terrain, including mountains, desert, forests, canyons, rivers, and lakes. Major recreation attractions are Bryce Canyon National Park, Dixie National Forest, and Grand Staircase-Escalante National Monument, and several scenic highways and backways. A number of developed and semideveloped campgrounds, day-use areas, back country roads, and trails exist for recreational use in the area. The analysis area for recreation (defined below) is managed by the BLM, NPS, USFS, UDWR, counties, and local municipalities.

The recreation resources analysis area for the Alton Coal Tract consists of the tract, linear features such as roads and OHV trails affected by mine-related activities, the reasonably foreseeable coal haul route, and all adjacent lands within a 5-mile radius of the tract (Map 3.12). A 5-mile radius (encompassing approximately 92,573 acres) was chosen on the assumption that recreational users affected by mining activities would move to lands that provide similar recreation opportunities that are immediately adjacent to the tract. Outside the 5-mile radius, additional recreation activities, areas, and opportunities were identified to describe the indirect and cumulative impacts of the alternatives. These areas were identified from BLM and USFS land use plans, NPS general management plans, UDWR management areas, discussions with BLM, USFS, and UDWR resource specialists, and county and municipality plans.

3.11.1 Bureau of Land Management Recreation Opportunities, Management Objectives, and Experiences

BLM manages the tract and adjacent areas as part of an extensive recreation management area (ERMA) for undeveloped and dispersed recreation opportunities. ERMA objectives include providing for visitor health and safety, limiting user conflict, and protecting resource values, with no activity-level planning required. Therefore, actions within ERMAs would generally be implemented directly from land use planning decisions. Dispersed camping is allowed throughout the recreation analysis area, which is managed as VRM Class IV, allowing for landscape modifications (see Section 3.2 Aesthetic Resources). OHV use is permitted on designated routes on BLM-managed lands within the analysis area. There are approximately 92 miles of routes available for OHV use within the recreation analysis area. Of the 92 miles, approximately 13 miles of routes are in the tract: 11 miles on BLM-managed land and 2 miles on private land. The BLM manages lands within the analysis area for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, competitive events, and viewing nature, wildlife, and geologic features. No other recreational trails or facilities are on BLM-managed lands within the recreation analysis area.

BLM also manages the Grand Staircase-Escalante National Monument. The monument was established in 1996 and is approximately 10 miles southeast of the analysis area. No portion of the monument is within the analysis area. However, it is expected that some recreation users, such as hunters, if displaced, would relocate their activities to similar ecological systems on the monument. Approximately 600,000 users visit Grand Staircase-Escalante National Monument each year. Areas within the monument adjacent to the analysis area are managed as an Outback Zone (BLM 1999) for undeveloped and self-reliant visitor experiences. Visitor facilities would be provided only for locations needed for resource protection. Most of the monument adjacent to the analysis area is managed as a VRM Class II and III.

Within the KFO, the BLM manages approximately 25,579 acres within the analysis area. In the KFO RMP all 25,579 acres within the analysis area are managed as an ERMA (BLM 2008b). Under the RMP, ERMAs provide for a range of undeveloped and dispersed recreation opportunities. Very little recreational use occurs on BLM-managed lands within the analysis area, with hunting being the predominant recreation activity. BLM does not have visitor use numbers for recreational activities occurring within the analysis area.

3.11.2 U.S. Forest Service Recreation Opportunities, Management Objectives, and Experiences

The Dixie National Forest has 17,397 acres in the recreation analysis area. The existing Dixie National Forest Land and Resource Management Plan (Dixie National Forest Plan) manages USFS lands within the analysis area as semiprimitive, nonmotorized zones and semiprimitive, motorized zones on the Recreation Opportunity Spectrum (ROS) (USFS 1986). Semiprimitive, nonmotorized zones are settings that have primitive roads or trails that are not open to motorized use. These zones are generally at least 2,500 acres in size and are between 0.5 and 3.0 miles from all roads, railroads, or trails with motorized use. Access to these zones is by nonmotorized trails, nonmotorized primitive roads, or cross-country. The analysis area contains a natural-appearing environment and has a high probability of solitude.

Semiprimitive, motorized zones are managed in a similar manner as the semiprimitive, nonmotorized zones. The only difference is that the semiprimitive motorized zone allows the use of motorized access on trails and roads within the area.

Dixie National Forest lands within the analysis area are managed for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, and viewing nature, wildlife, and geologic features.

There is limited motorized access to Dixie National Forest lands within the analysis area. Few roads access these locations and therefore, little recreation use occurs in these areas. Existing recreational facilities on nearby Dixie National Forest lands include the nonmotorized, 78-mile-long, Grand View trail that runs from the Thunder Mountain trailhead to the Sheep Creek trailhead. The Paunsaugunt OHV trail system also runs through Dixie National Forest lands near the analysis area. Dixie National Forest does not maintain visitor use information for lands near the analysis area.

Portions of the Dixie National Forest within the analysis area are managed under several management prescriptions (recreation, wood production and utilization, and livestock grazing) developed in the Dixie National Forest Plan. Management prescriptions are distinct from ROS zones in that they are intended to provide management guidelines for many different types of uses on the Dixie National Forest, and not just recreational use.

Approximately 12,070 acres of the analysis area is in the recreation management prescription. This management prescription provides guidelines for a broad range of outdoor recreation activities that meet recreational demands, and allows for a broad range of low-cost, dispersed recreation opportunities.

Approximately 4,470 acres of the analysis area are in the wood production and utilization management prescription. This management prescription is designed to manage for wood and fiber production. However, along forest roads, the USFS manages the area for a semiprimitive, motorized experience and a semiprimitive, nonmotorized experience in nonroaded areas within the zone.

Finally, approximately 855 acres of the analysis area are in the livestock grazing management prescription. This management prescription is designed to manage for intensive livestock grazing. The prescription also allows for dispersed recreation, with opportunities ranging from semiprimitive, nonmotorized to roaded natural on the ROS.

3.11.3 Bryce Canyon National Park Recreation Opportunities, Management Objectives, and Experiences

The southwest boundary of Bryce Canyon National Park is approximately 10 miles east of the tract. The park is open year-round and over the past five years, annual park attendance has averaged roughly 1.5 million visitors. The NPS provides visitors with numerous opportunities to explore the landscape and experience a relaxing, peaceful encounter in the outstanding natural setting of Bryce Canyon National Park.

Although Bryce Canyon National Park is outside the recreation analysis area, roads to the park may be affected by mine-related actions if they overlap the reasonably foreseeable coal haul route, and some recreational settings may be affected by mine operations (see Section 3.2 Aesthetic Resources for more information on visual resources and nightscapes; see Section 3.3 Air Resources for more information on visibility).

Over 99% of the park is managed for recreational activities. The *Bryce Canyon National Park General Management Plan* (NPS 1987) provides approximately 37% (13,325 acres) of the park as the natural environmental subzone, where lands are managed for preservation of natural features and no development is allowed. Approximately 62% (22,325 acres) of the park is managed as the wilderness subzone, where lands are managed to retain eligibility for wilderness designation in accordance with criteria developed for wilderness designation under the Wilderness Act of 1964. The remainder of the park (185 acres) is managed for preservation of historic features and development of facilities for park management.

Recreation use in Bryce Canyon National Park includes hiking, backpacking, camping, cross-country skiing, photography, picnicking, and viewing nature, wildlife, and geologic features. Hunting is not allowed in Bryce Canyon National Park.

3.11.4 Utah Department of Wildlife Resources Recreation Opportunities, Management Objectives, and Experiences

The UDWR manages hunting and fishing in Utah. The tract is in UDWR's PPMA. This management area (approximately 957,122 total acres in size) is open to all small-game hunting; hunting for mule deer and elk is managed through a permit system. The UDWR manages big game hunting in the PPMA as a trophy hunting area, with high buck-to-doe ratios for mule deer. Combined with limited hunting permits, the area is also popular for wildlife viewing of trophy mule deer, particularly because the area is between high visitation sites, such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument.

For the 2007 hunting season, approximately 180 mule deer permits were issued for the PPMA. The UDWR allocated approximately 34 permits for archery only, 50 permits for muzzleloader only, and 96 permits for any weapon. In 2007 success rates for mule deer ranged from 68% for archery to 78% for muzzleloader and any weapon permits, with 100% of all permits being used.

Also in 2007, approximately 33 elk permits were issued for the management area, with nine permits allocated to archery only, five permits for muzzleloader only, and 19 permits for any weapon. The 2007 success rates for elk ranged from 17% for archery only to 45% for any weapon. The muzzleloader-only success rate was 20%. Approximately 97% of all 2007 tags were used in the PPMA.

There are no data on the number of hunters using the PPMA for hunting other species (predominantly small game), but UDWR believes most small-game hunters are from nearby communities (Aoude 2008).

Finally, Upper Kanab Creek has a small rainbow trout fishery, but no fishing occurs on or near the tract (Hadley 2008).

The tract falls within a cooperative wildlife management unit (CWMU), the Alton CWMU. A CWMU is a hunting area consisting primarily of private lands. Its management involves cooperation with public agency land managers to manage healthy and diverse populations of big game animals. The Alton CWMU is 43,658 acres and ranges in elevation from 5,500 feet to 9,000 feet. Public hunting is permitted from June through December (CWMU 2008). Within the Alton CWMU, 21 deer permits and four elk permits are issued each year. According to the CWMU contact, the tract does not fall within prime CWMU deer or elk habitat, and over the past 20 years, there have been no deer or elk kills in the proposed tract (Heaton 2009).

3.11.5 Designated Highways Recreation Opportunities, Management Objectives, and Experiences

The National Scenic Byways Program was established under the Intermodal Surface Transportation Efficiency Act of 1991, and reauthorized in 1998 under the Transportation Equity Act for the 21st Century. Under the program, the U.S. Secretary of Transportation recognizes certain roads as National Scenic Byways or "All-American Roads" based on their archaeological, cultural, historic, natural, recreational, and scenic qualities. There are 126 such designated byways in 44 states. The Federal Highway Administration manages the National Scenic Byways system to maintain the defined qualities of a designated road segment as a scenic byway. Utah scenic byways are managed by the Utah Office of Tourism and are also managed to maintain the defined qualities of a designated road segment as a state scenic byway

Mine-related activities would result in the use of several transportation corridors along the reasonably foreseeable coal haul route that have been designated as scenic byways and that lead to recreation areas. US-89 is designated as a State of Utah scenic byway from the intersection with SR-12 south to the City of Kanab. It is also known as the Mount Carmel Scenic Byway and is designated as a National Heritage Highway. The road provides access to the Dixie National Forest and BLM-managed lands within the recreation analysis area.

SR-12 is another designated scenic byway. It has been designated as an All-American Road, a state scenic byway, and a national forest byway. The road accesses portions of Dixie National Forest, Bryce Canyon National Park, Grand Staircase-Escalante National Monument, and Kodachrome Basin State Park. The road is popular for sightseers and visitors to Bryce Canyon and Capitol Reef national parks and would not be utilized as part of the reasonably foreseeable coal haul transportation route. The East Fork of the Sevier Scenic Byway (SR-12) travels south from SR-12 through the Sevier River Valley with the Paunsaugunt Plateau west of the byway and the Pink Cliffs to the east. The byway follows the river the entire way, passing Tropic Reservoir about halfway. From US-89, 9 miles east of Kanab, the Johnson Canyon/Alton Amphitheatre Scenic Backway first passes through portions of the Grand Staircase-Escalante National Monument, including the vermillion cliffs, then climbs into the white cliffs. The Alton road spur of the byway travels north to Alton and provides better views of the pink cliffs, the Alton Amphitheater, and extinct volcanoes. The Alton road then loops northeast rejoining US-89 north of Glendale.

3.11.6 Transportation and Recreation

Recreationists currently use portions of the reasonably foreseeable coal haul transportation route (see Section 2.6.4) for sightseeing, travel, or both to and from other recreation destinations described here. A transportation study (Fehr & Peers Transportation Consultants 2013) evaluates the existing condition of traffic on this route. The results of this study detailing the affected environment for transportation are included in Section 3.14 Transportation.

3.11.7 Other Recreation Opportunities, Management Objectives, and Experiences

Garfield and Kane counties both have management plans that provide direction for management of various activities within both counties. The Garfield County management plan has not completed the section regarding recreation management at this time. In the management plan, the county states that the "management direction for the Resource/Resource Use (Recreation) will be completed, subject to public comment, and adopted at some point in the future" (FCAOG 2007a). However, the plan does establish land use management areas, including several recreation areas ranging from wilderness to developed recreation. According to the plan, areas around the tract are managed as Recreation II zones. Recreation II zones provide for the following:

> Motorized and nonmotorized recreation activities such as driving for pleasure, viewing scenery, picnicking, fishing, snowmobile riding, and cross country skiing are possible. Motorized travel may be restricted to designated routes to protect the physical and biological resources. Visual resources are managed so that management activities maintain or improve the quality of recreation opportunities. Management activities are not evident, remained visually subordinate, or may be dominant, but harmonize and blend with the natural setting. Landscape rehabilitation is used to restore landscapes to a desirable visual quality. Enhancement aimed at increasing positive elements of the landscape to improve visual variety is also used. Dispersed recreation is only lightly managed, and management prescriptions are generally limited to situations necessary to maintain ecological stability and visual objectives of the management area. These lands are generally managed for VRM Class III. (FCAOG 2007a)

The *Kane County, Utah General Plan* (FCAOG 2011) does not provide specific management direction for all recreation within the county. Much of the land within and adjacent to the tract is managed for agriculture. The agriculture zone does not provide any management prescriptions for recreation. However, the plan does provide for management direction relating to recreational use of federal public lands within the county. It contains a request for federal agencies to provide for multiple recreation uses in Kane County by maintaining existing amenities and providing new recreation sites for the public's enjoyment. It also contains a request for agencies to pursue motorized and nonmotorized public access opportunities and to collect, review, and analyze data on recreation use within the county.

3.12 Socioeconomics

3.12.1 Demographic Overview

In accordance with NEPA, this analysis of the local social and economic conditions addresses the relationships between the Alton Coal Tract and the communities and socioeconomic resources it may affect. The following characterization of current social and economic conditions describes the culture, demographics, employment, tourism, income, fiscal and budgetary information, community facilities, and EJ communities in the region that could be affected by coal mining activities related to the tract. Numerical data in this section have been updated since the DEIS whenever appropriate, based on more recent U.S. Census Bureau (census) numbers and current economic conditions.

The analysis area for social and economic resources (the tract's socioeconomic study area [SESA]) comprises Kane, Garfield, and Iron counties. Although the tract is in Kane County, 0.10 mile south of the town of Alton, impacts to the surrounding counties are analyzed given the potential number of employees that may commute from surrounding counties, the reasonably foreseeable coal haul route, and the reasonably foreseeable rail loadout location.

3.12.1.1 SOCIAL SETTING

Presently, the SESA comprises a collection of rural communities characterized by pastoral landscapes, open space, and small town qualities. Many of the area's residents are of the Church of Jesus Christ of Latter Day Saints pioneer heritage and are proud of the values, customs, and culture that have resulted from their historical connections and lifestyle (FCAOG 2011). Area residents are generally interested in maintaining a rural lifestyle and quality of life that have been important parts of their past. According to the *Garfield County General Plan*, the county is committed to protecting the "custom, culture, and welfare of Garfield County's visitors and residents while providing for the conservation, use and/or enjoyment of its resources" (FCAOG 1998). In Kane County, 90% of the land is under federal ownership, and an additional 3.8% of the land base is controlled by SITLA, managed for the purpose of generating revenues for public institutions and education. In Garfield County, 90.1% of the land is federal and 4.7% is SITLA land (Utah Office of Tourism 2013a).

Because federal and state governments control more than 95% of the land in Kane and Garfield counties, many residents believe that much of the county's potential wealth is tied to its public lands. Therefore, a large number of residents are particularly interested in public land use management decisions, and county leaders are interested in developing cooperative working relationships with government agency managers (FCAOG 2007a). In addition, most of the local government revenues in Kane County come from *ad valorem* property tax and sales tax receipt shares. However, because so much of the land in the county is not available for development, the amount of property tax revenues that the county can collect is limited. Therefore, from Kane County's perspective, multiple use activities on federal lands in the county are critical to the continued vitality of its tax base (Kane County 2012).

Although Iron County has a greater percentage of lands under private ownership (29%), the social values and attention paid to public land management issues are similar to that of Kane and Garfield counties. According to the *Iron County Local Planning Summary*, the first goal of the *Iron County General Plan* is to "retain control of the issues which effect [affect] the County's custom, culture and economic stability" (2003).

The SESA is also home to Bryce Canyon National Park, which straddles Garfield and Kane counties. Approximately 75% of the park and its entrance are in Garfield County, whereas the other 25% of the park is in Kane County. Therefore, most of the tourism access to Bryce Canyon occurs in Garfield County by US-12. Cedar Breaks National Monument is also in the SESA in Iron County, approximately 60 miles west of Bryce Canyon.

3.12.1.2 POPULATION AND DEMOGRAPHICS

Due to the aridity, ruggedness, and isolation of the Alton Coal Tract, the overall population of the SESA is sparse. Garfield County has a population density of approximately 1.0 person per square mile, Kane County has 1.8 people per square mile, and Iron County has approximately 14.0 people per square mile (higher than Garfield and Kane counties but approximately half the state average of 33.6 people per square mile) (U.S. Census Bureau 2013d, 2013e, 2013c).

Despite the small population relative to the geographic size of the counties, the population rates have steadily increased in recent years (Table 3.12.1). Since 1990, Kane County's population has increased 38.6% to 7,137 in 2010. The population increase over this time period can be attributed almost equally to in-migration (more people moving into the county than out, at approximately 880 people), as well as natural population increase (births minus deaths, at approximately 730 people). The annual population increase in Kane County averaged 1.2 % from 1990 to 2010. The Town of Alton reported 119 residents in 2010, a 28% increase from 1990. The largest city in Kane County is Kanab, with a population of 4,312 in 2010 (U.S. Census Bureau 2013l, 2013a; UDWS 2010). See Table 3.12.1 for county population growth figures.

Garfield County, located directly north of Kane County, has experienced similar growth patterns. The population has steadily increased (30.6%) since 1990 to 5,184 in 2010. The cities with the largest populations are also the areas experiencing the greatest amount of growth. These cities (populations in parentheses) are Panguitch (1,520), Escalante (797), and Tropic (530) (UDWS 2008a).

Iron County's population is nearly eight times higher than Kane and Garfield counties and has expanded rapidly in recent years. Overall, the county's population more than doubled, with a 121.3% increase from 20,910 in 1990 to 46,272 in 2010. Cedar City maintains the bulk of the county's residents with a 2010 population of 28,857. However, population growth slowed dramatically in 2009. The county's annual growth rate of 1.0% in 1990 ranked below the statewide average growth rate of 1.5% and well below the average annual growth rate of 4.0% that the county boasted from 1990 to 2008. From 2008 to 2010, the birth rate and natural population increase totaled 1,814, but persons leaving the county from 2008 to 2010 totaled 416, marking the first time since 1989 that net migration was negative (U.S. Census Bureau 2013l).

Table 3.12.1. Population Characteristics of the Alton Coal Tract Socioeconomic Study Area

	1990	2000	2010	Percentage Change Since 1990
Kane County	5,150	6,037	7,137	38.6%
Garfield County	3,970	4,763	5,184	30.6%
Iron County	20,910	34,079	46,272	121.3%
State of Utah	1,729,227	2,246,553	2,800,089	61.9%
Town of Alton	93	134	119	28.0%

Source: U.S. Census Bureau (2013l).

3.12.1.3 HOUSING AND PROPERTY VALUES

This section characterizes the existing conditions of housing and property values in the SESA as they relate to the potential mine impacts. With regard to housing, impacts to property values are often of particular interest to local residents when considering changes to existing land uses in their community. Some comments submitted during the original scoping period for the Alton Coal EIS expressed concern that the mine would cause a decrease in the area's property values. Other comments received at the Fair Market Value Hearing and other local scoping meetings expressed the opposite opinion and provided comments about the benefits of a mine. Comments received on the DEIS echoed these opinions. In sum, residents in the region and others expressed interest that development of a surface coal mine could do the following:

1. Impact property values a) positively in terms of value increases due to proximity to employment opportunities, and b) negatively in terms of value reductions due to proximity to a mine site
2. Impact economic activity a) positively in terms of increased employment and businesses activity, and b) negatively in terms of lost revenue for the local tourism industry (if tourists were to be deterred from visiting the area)
3. Change the area's quality of life a) positively in terms of providing employment for the rising generation, and b) negatively in terms of the potential to lose the sense of place currently derived by the rural culture and proximity of Bryce Canyon National Park along with other recreation opportunities on SESA public lands

The census estimates that from 2007 to 2011, Garfield County had 3,644 housing units, of which 1,500 (41.2%) were vacant. The median home value for the same time period was $149,500. Table 3.12.2 displays similar figures for Garfield County's largest towns (Panguitch, Escalante, and Tropic) and resort communities (Boulder, Bryce Canyon, Panguitch, and Tropic). Panguitch and Tropic fall into both categories. Each of Garfield County's towns listed below had median home values below the county median, except for the town of Boulder, which saw median home values estimated at $169,400, nearly 15% above the county median (U.S. Census Bureau 2007–2011a).

Table 3.12.2. Housing Statistics for Resort Communities in the Socioeconomic Study Area

Town	Driving Distance to the Tract (miles)	Total Housing Units	Occupied Housing Units	Vacant Housing Units	Vacancy Rate (%)	Median Home Value ($)
Boulder	118	128	97	31	24.2%	$169,400
Brian Head	48	1,268	25	1,243	98.0%	$1,000,000 or more
Bryce Canyon	48	77	35	42	54.5%	$143,800
Escalante	89	520	414	106	20.4%	$133,300
Kanab	39	2,165	1,967	198	9.1%	$177,800
Orderville	17	277	237	40	14.4%	$143,800
Panguitch	36	808	671	137	17.0%	$128,600
Tropic	51	319	271	48	15.0%	$140,200

Source: U.S. Census Bureau (2007–2011a).

Note: Resort communities are characterized by the Utah Office of Tourism and the Utah State Tax Commission.

From 2007 to 2011, Iron County had an estimated 19,330 housing units, of which 4,017 (20.8%) were vacant. The median home value for the same time period was $196,400. Cedar City, the largest town in Iron County, had nearly half (11,069) of these housing units, with a vacancy rate of only 10.4% (1,147 units) and a median home value above the county median at $201,000. Brian Head, Iron County's only resort community, had approximately 1,268 housing units with a median home value of $1,000,000 or more (well over the county median). A popular skiing resort destination, Brian Head, had only 25 occupied housing units according to the census, or a 2% occupancy rate (U.S. Census Bureau 2007–2011a). Lastly, Kane County had 5,686 housing units, of which 2,473 (43.5%) were vacant. The median home value for the same time period was $171,600. Kanab, the largest town in Kane County and also considered a resort community, had 2,165 of these housing units with a vacancy rate of only 9.1% and a median home value above the county median at $177,800. Orderville, a small resort community 17 miles from the tract by car, had 277 housing units with a median value below the county median of $143,800, of which 237 or 85.6% were occupied. Alton, with 63 housing units, had 10 vacant homes (15.9%) and a median home value of $195,000, 13.6% above the county median (U.S. Census Bureau 2007–2011a).

3.12.1.3.1 Property Taxes

Property tax revenue helps fund state and local governments' operating budgets as well as school and fire districts. Statewide, over 50% of property tax revenues are allocated to schools, followed by counties (20%), special districts (14%), and cities and towns (13%). Counties use property tax revenue to fund court systems, sheriffs' departments, transportation projects, emergency services, and tax relief to the indigent, blind, and veterans.

Property tax impacts could occur near the tract due the physical change in land use and the concentration of mining activities in and around the Alton Coal Tract; as such, existing property values within Kane County (the county in which the mine would be located) are evaluated here. State of Utah numbers are given for comparative purposes. In 2011, the average estimated residential sales price in Kane County was $160,569 and the primary residential tax rate was 0.006271. The effective tax rate equals the average of the total residential taxes charged divided by the average of the total residential market values. The average property tax paid in Kane County in 2011 was $1,007. Of the $1,007, on average, $420 went to the county, $473 to the school districts, $56 to cities and towns, and $58 to special districts. By comparison, the 2011 statewide average estimated residential sales price was $195,817, and the primary effective tax rate was 0.006535, making the average property tax payment for the state of Utah $1,248 (Utah State Tax Commission 2007).

In 2011, property taxes paid by all Utah Coal Mines in the state totaled $4.32 million dollars (Hogue 2012).

3.12.1.3.2 Second-home Ownership

Second-home ownership is an important trend occurring in southern Utah. Tracking second-home ownership accurately by disclosing the percentage and valuation of new second-home permits versus permits for new houses for full-time residents can be challenging. This challenge can be mitigated by looking at property taxes collected on primary residences (dwellings used as a person's primary residence) versus nonprimary residences (mainly second homes), because they are taxed at different rates. Property taxes in Utah are levied on primary residential properties at 55% of fair market value, whereas nonprimary residential properties are taxed at 100% of fair market value. Table 3.12.3 shows actual property taxes charged against primary and nonprimary residential properties as well as each type's share of the total taxable value of residential properties in the county for the year 2011.

Table 3.12.3. Tax Comparisons of Primary and Nonprimary Residential Property in the Socioeconomic Study Area in 2011

County	Property Taxes Charged Against Primary Residential Properties ($)	Property Taxes Charged Against Nonprimary Residential Properties ($)	Share of Total Taxable Value for Primary Residential Properties (%)	Share of Total Taxable Value for Nonprimary Residential Properties (%)
Garfield	$1,207,759	$1,701,719	40%	60%
Iron	$14,445,096	$7,215,357	65%	35%
Kane	$2,339,272	$4,534,107	35%	65%

Source: Utah State Tax Commission (2012).

In Garfield County in 2011, approximately 60% of the taxable value for residential property was in the nonprimary category, pointing to a high percentage of second versus primary homes. The same was the case for Kane County, with only 35% of residential taxable value coming from primary residences. Iron County, which is home to the largest city in the SESA (Cedar City with a 2010 population of 28,857), had the opposite balance, with only 35% of residential taxable value coming from nonprimary residences (Utah State Tax Commission 2012).

According to the *Kane County, Utah General Plan* (Kane County 2011), over 30% of total county housing units were considered seasonal or recreational (the highest percentage of the total units in the five southwestern Utah counties), with the largest concentration of these located near Bryce Canyon National Park in Cedar Mountain and Deer Springs. These data are consistent with the taxation figures listed in Table 3.12.3. The general plan also notes that new residential construction, although remaining steady from the 1970s through the mid-1990s, increased substantially from 1994 to 2006, with approximately 50% of the new construction attributable to seasonal or recreational housing.

Recent studies indicate that second homes are typically built based on scenic beauty and recreation potential. A Colorado-based study reports that 95% of second-home owners selected their homes based on scenery, and 91% cited recreation opportunities as being important amenities that influence their decision (Venturoni et al. 2005). Initially, the construction of new second homes may be beneficial because they increase the local property tax base. However, a high concentration of second homes may also be problematic for local residents because they can increase the cost of living for local residents by increasing property taxes. In Utah, this effect is partially mitigated by the previously discussed 45% exemption for primary residential property taxes (versus nonprimary residential properties, which are taxed at 100% of assessed value). There still remains potential for conflict within communities between second-home owners and full-time residents because full-time residents often desire to diversify their economic base, become less dependent on tourism, and meet the basic needs of the community with respect to affordable housing and education (Venturoni et al. 2005). Most of the second homes in Kane County are on Cedar Mountain (approximately 30 miles from the tract), whereas those in Iron and Garfield counties are even further away from the tract (see Table 3.12.2 for driving distances from resort communities to the tract).

3.12.1.4 EMPLOYMENT AND INCOME

The labor market in the SESA has been subject to the impacts of the slowing economy in recent years. The unemployment rates in the SESA and across the state have fluctuated since the year 2000. See Figure 3.12.1 for unemployment trends in the SESA.

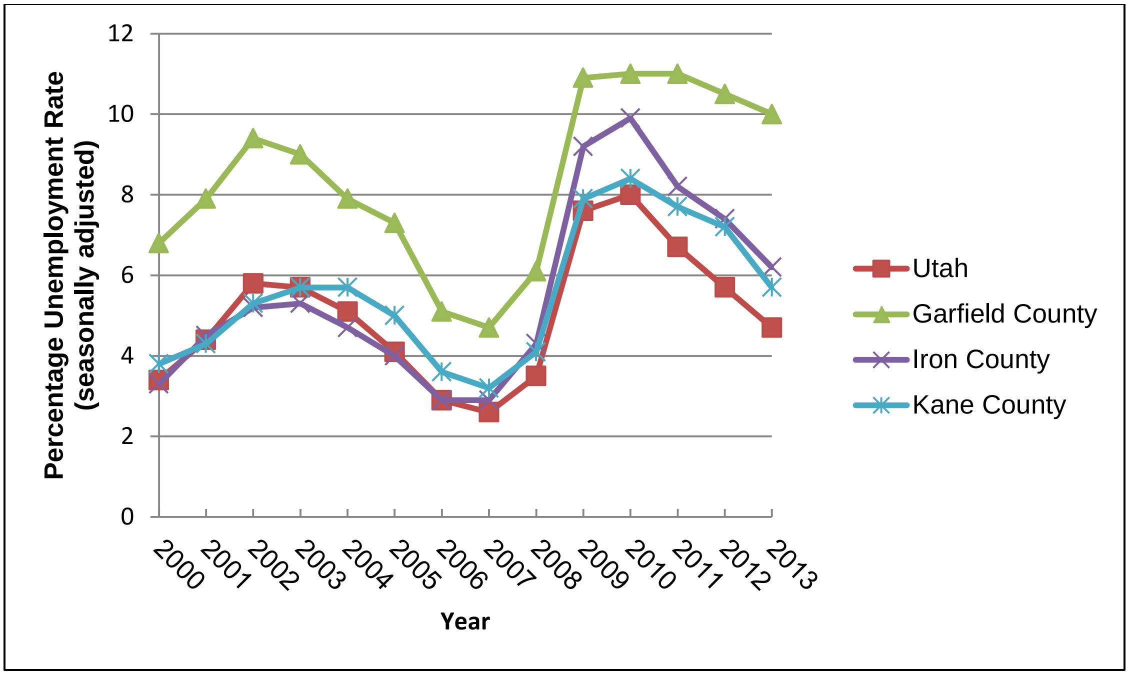

Figure 3.12.1. Unemployment rate in the socioeconomic study area in 2000–2013 (UDWS 2013a).[2]

Job losses have been prevalent across a range of industries, but they have been most heavily concentrated around the construction and manufacturing industries. See Table 3.12.4 for characteristics of the SESA's labor force.

Table 3.12.4. Labor Force Characteristics of the Alton Coal Tract Socioeconomic Study Area in 2012

	Labor Force	Employed	Unemployed	Percentage Unemployment Rate
Garfield County	2,741	2,454	287	10.5%
Kane County	3,339	3,098	241	7.2 %
Iron County	19,195	17,772	1,423	7.4%
State of Utah	1,353,597	1,276,249	77,348	5.7%

Source: UDWS (2013a).

According to UDWS, the average monthly income in each county in the SESA is substantially lower than the state average (Table 3.12.5). The low wages are attributed to the high percentage of lower-paying, seasonal, tourism-related jobs in Kane and Garfield counties, and to a large working student population in Iron County. The minimum wage in Utah has been $7.25 (same as the federal minimum wage) since July 2009.

[2] Unemployment figures are annual averages except 2013, which is the monthly figure from April 2013.

Table 3.12.5. Alton Coal Tract Socioeconomic Study Area Income and Wages in 2010

	Kane County	Garfield County	Iron County	State of Utah
Total personal income (millions)	$225.0	$142.3	$1,072.3	$90,250.2
Per capita income	$31,454	$27,439	$23,164	$32,517
Average monthly nonfarm wage	$2,238	$2,205	$2,288	$3,235

Sources: UDWS (2013b, 2013c).

Despite the lean job market and low wages, total personal income in the combined SESA rose 29% from approximately $1.1 billion in 2005 to approximately $1.4 billion in 2010. However, only 43% of the SESA's total population is considered part of the workforce (both employed and unemployed) (UDWS 2013d).

The distribution of employment by industry sector in the SESA appears in Table 3.12.6. Throughout the SESA, government is the predominant employer, with an average of 27% of the labor force in each county employed in this industry sector. The leisure and hospitality sector also accounts for numerous jobs in the SESA. Garfield County has the highest percentage (42%) of the labor force employed in the leisure and hospitality sector. One of the largest employers in Garfield County is Ruby's Inn. Other tourism-based employers in the county are Bryce Canyon Resort, Offshore Marina, Bryce Canyon Pines, and the New Western Motel. In Kane County, where 30% of the workforce is employed in the leisure and hospitality sector, Aramark (Lake Powell Resorts) is one of the largest employers. Best Friends Animal Society is also one of the largest employers and hosts nearly 30,000 visitors a year (Best Friends Animal Society 2011). Iron County maintains fewer jobs (13%) in the leisure and hospitality sector. However, the Utah Shakespeare Festival held at Southern Utah University in Cedar City draws thousands of tourists to Iron County annually and employs approximately 250 individuals in the summer and fall (Utah Shakespeare Festival 2013). Table 3.12.6 breaks down employment by sector in the SESA.

Table 3.12.6. Employment and Percentage Share by North American Industry Classification System Industry Sector in 2011

	Kane County	Garfield County	Iron County	Total per Sector (average percentage share over the SESA)
Natural resources and mining	5	9	99	113
	0.2%	0.4%	0.7%	0.4%
Construction	88	41	570	699
	2.9%	1.8%	3.8%	2.8%
Manufacturing	99	40	1,370	1,509
	3.3%	1.7%	9.1%	4.7%
Trade/transportation utilities	413	259	2,684	3,356
	13.8%	11.2%	17.7%	14.2%
Information	17	91	115	223
	0.6%	3.9%	0.8%	1.8%

Table 3.12.6. Employment and Percentage Share by North American Industry Classification System Industry Sector in 2011

	Kane County	Garfield County	Iron County	Total per Sector (average percentage share over the SESA)
Financial activities	109	27	707	843
	3.6%	1.2%	4.7%	3.2%
Professional/business services	52	18	1,158	1,228
	1.7%	0.8%	7.6%	3.4%
Education/health/ social services	113	231	1,707	2,051
	3.8%	10.0%	11.3%	8.4%
Leisure/hospitality (tourism)	906	964	1,910	3,780
	30.2%	41.6%	12.6%	28.1%
Other services	462	17	315	794
	15.4%	0.7%	2.1%	6.1%
Government	740	620	4,498	5,858
	24.6%	26.8%	29.7%	27.0%
Total	**3,004**	**2,317**	**15,132**	**20,453**

Source: UDWS (2013a).

Over time, nonfarm jobs and wages in Garfield County fluctuated between 2,260 jobs with an average monthly wage of $1,907 in 2006 and 2,317 jobs with an average monthly wage of $2,130 in 2011. The county lost 2.3% of these jobs from 2010 to 2011, and the average monthly wage dropped from $2,204 to $2,130. Iron County had 16,806 nonfarm jobs in 2006 (average monthly wage of $2,055) and 15,132 jobs in 2011 (average monthly wage of $2,319), losing 1,674 jobs over the time period. Lastly, Kane County lost 88 nonfarm jobs from 2006 to 2011, but saw an average monthly wage increase of $364 over the same time period. Most of the jobs in each county lost over this five-year period were in the construction sector, which lost on average 10% of its sector jobs in Garfield County, 21% in Iron County, and 11% in Kane County (UDWS 2013d).

The mining and natural resources development sector represents the lowest employment sector in the SESA, accounting for less than 1% (113) of SESA jobs. Data from the U.S. Department of Labor's Bureau of Labor Statistics Quarterly Census of Employment and Wages for the coal mining sector (North American Industry Classification System Code 2121) were not available for any county in the SESA. The report *The Utah Coal Industry: Economic and Fiscal Impacts* (Hogue 2012) estimates that in 2011, the Utah coal mining industry directly employed approximately 1,748 persons with associated wages averaging $77,520 and total compensation (wage plus benefits) averaging $90,000. Thus, the coal mining sector provided for $132.0 million in wages and $155.0 million in total compensation in 2011. These wages are substantially above the statewide wage average of $40,898/year. In addition, though the service sector employed higher numbers of individuals in 2011 (2,107), average wages were also much lower at $30,396 annually (Hogue 2012). In addition, Hogue (2012) estimates that Utah's coal mining industry provided an additional 2,952 indirect jobs in the state. Indirect jobs result from economic linkages between the coal industry and other industries, and by the economic activity stimulated by the expenditure of associated wage earnings. These 2,952 indirect jobs accounted for an estimated $123.0 million in employee compensation in 2011. Therefore, direct and indirect compensation from coal mine industry jobs totaled approximately $278 million in 2011 (Hogue 2012).

3.12.1.4.1 Economic Contribution of Utah-produced Coal for Export

In 2011, United States coal exports totaling 107 million short tons resulted in significant economic contributions, and accounted for approximately 10% of total United States coal production (Ernst & Young LLP 2013). According to the report *U.S. Coal Exports: National and State Economic Contributions* (Ernst & Young LLP 2013), Utah ranked 15th overall, accounting for a 2% share (19 million short tons) of total United States coal production in 2011. Of this, approximately 6% (1.1 million short tons) of Utah-produced coal was exported abroad. Using economic multipliers derived from the 2010 IMPLAN input-output model, the report estimates the additional direct, indirect, and induced economic contributions of Utah's exported coal in the form of employment, labor income, and gross value added within three distinct categories: export coal production, downstream transportation, and port operations and cargo handling. Economic contribution figure estimates attributable to the export of Utah's coal from the 2013 report are shown in Table 3.12.7.

Table 3.12.7. Economic Contribution of Utah-Produced Coal for Export in 2011

Estimated Economic Contribution	Category	Direct	Indirect and Induced	Total
Employment (number of full- and part-time employees)	Export coal production	200	610	810
	Downstream transportation	80	370	450
	Port operations and cargo handling	–	30	30
	Total	**280**	**1,010**	**1,290**
Labor income (millions of 2011 dollars)	Export coal production	$19	$28	$47
	Downstream transportation	$9	$14	$23
	Port operations and cargo handling	–	$1	$1
	Total	**$27**	**$43**	**$71**
Gross value added (millions of 2011 dollars)	Export coal production	$37	$52	$89
	Downstream transportation	$15	$25	$40
	Port operations and cargo handling	–	$2	$2
	Total	**$53**	**$79**	**$131**

3.12.1.5 TOURISM

As mentioned in Section 3.11 (Recreation), numerous recreation and tourism opportunities are near the tract and along the reasonably foreseeable coal haul route. Bryce Canyon National Park, Dixie National Forest, and Grand Staircase-Escalante National Monument are major tourist attractions in the area. In general, spending by travelers in the SESA has fluctuated in recent years. The fluctuations in traveler spending are attributed to the weakening in the United States economy since 2007. Over the five-year period from 2006 to 2011, traveler spending in Garfield County increased from $55.7 million to $82.3 million, a 33% increase when adjusted for inflation. Spending by travelers in Kane County increased from $70.5 million in 2006 to $100.8 million, a 28% increase; and in Iron County, travelers spent $100.3 million in 2011, 7% less than the $96.7 million spent 2006 (when adjusted for inflation) (Utah Office of Tourism 2009). Table 3.12.8 reflects various travel and tourism contributions to the SESA in 2011.

Table 3.12.8. Alton Coal Tract Socioeconomic Study Area Tourism Profile 2011

	Kane County	Garfield County	Iron County	SESA Totals
Spending by travelers (millions)	-$100.8	-$82.3	$100.3	$283.4
Travel and tourism-related employment	1,820	1,486	1,812	5,118
Local tax revenue from traveler spending (000s)	$5,314.4	$4,339.1	$5,292.3	$14,945.8
State ranking (spending by travelers per county)*	12th	14th	9th	–

Source: Utah Office of Tourism (2013a).

* Data for 2009 state rankings are for 2009 because updated information was not available.

Individuals who participated in the scoping process reported that tourists to the area contribute significantly to the local economy. In the SESA, there are numerous tourism-based businesses (bed and breakfasts, resorts, hotels, etc.) for visitors who visit the national parks and other tourist destinations in the area. According to local residents, tourism and recreation are the primary industries currently using the reasonably foreseeable coal haul transportation route. Locals have also reported a growing number of bicycling and motorcycling tours along US-89.

Visitors to the area contribute to the local economy by direct spending, tourism-related employment, and tourism-based tax revenues. Tourism tax revenues are derived from transient room tax, restaurant tax, car rental tax, and gross taxable retail sales. Tables 3.12.9, 3.12.10, and 3.12.11 and Figures 3.12.2 and 3.12.3 further break down tourism tax revenues in the SESA over time (figures for car rental tax were not available).

Table 3.12.9. Transient Room Tax Revenues 2008–2012

County	2008	2009	2010	2011	2012	Total Over Five Years
Garfield	$1,069,707	$1,106,964	$1,152,762	$1,152,728	$1,161,530	$5,643,691
Iron	$838,162	$732,181	$839,377	$843,708	$908,439	$4,161,867
Kane	$695,688	$688,404	$1,050,038	$1,100,587	$1,336,608	$4,871,325

Source: Utah Office of Tourism (2013b).

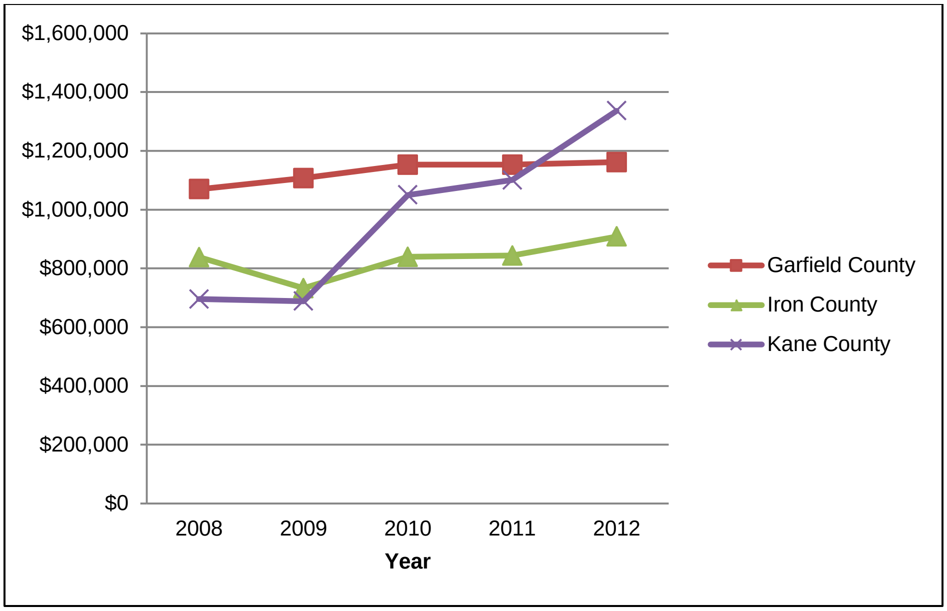

Figure 3.12.2. Transient room tax revenues 2008–2012 (Utah Office of Tourism 2013b).

Table 3.12.10. Restaurant Tax Revenues 2008–2012

County	2008	2009	2010	2011	2012	Total Over Five Years
Garfield	$160,684	$168,137	$176,301	$188,040	$181,652	$874,814
Iron	$473,622	$458,375	$468,710	$500,612	$521,469	$2,422,788
Kane	$118,087	$122,813	$134,638	$142,271	$153,411	$671,220

Source: Utah Office of Tourism (2013b).

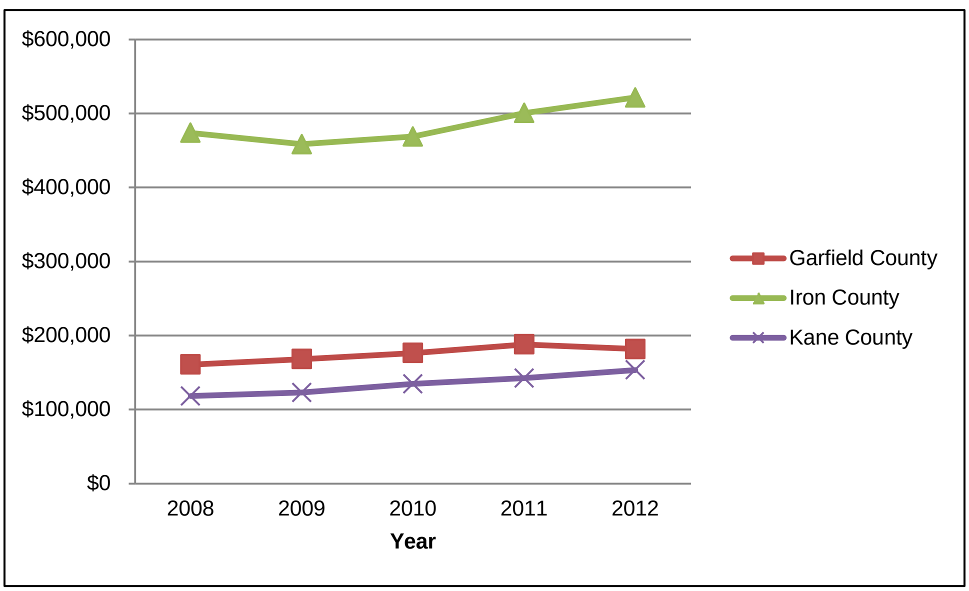

Figure 3.12.3. Restaurant tax revenues 2008–2012 (Utah Office of Tourism 2013b).

The figures and tables above show that both transient room tax and restaurant tax revenues have generally increased year over year from 2008 to 2012 for each county in the SESA. However, Garfield County experienced a 3.4% decrease in restaurant tax revenues from 2011 to 2012. Table 3.12.11 shows resort communities sales tax revenues from 2008 to 2012, most of which declined over the five-year period. Bryce Canyon City in Garfield County saw the greatest five-year sales tax revenue increase of 5.4%, but experienced a drop of $35,556 (a 10.7% decrease) in revenues from 2011 to 2012.

Table 3.12.11. Socioeconomic Study Area Resort Communities Sales Tax Revenues 2008–2012

County	Community	2008	2009	2010	2011	2012	Total Over Five Years	Percentage Change over Five Years
Garfield	Boulder	$36,196	$42,515	$33,264	$31,106	$32,936	$176,017	-9.01%
Garfield	Bryce Canyon	$281,803	$305,935	$325,202	$332,566	$297,010	$1,542,516	5.40%
Garfield	Panguitch	$201,937	$151,315	$158,011	$164,088	$178,606	$853,957	-11.55%
Garfield	Tropic	$75,533	$47,921	$51,881	$54,290	$53,243	$282,868	-29.51%
Iron	Brian Head	$245,675	$211,179	$224,636	$218,152	$221,255	$1,120,897	-9.94%
Kane	Kanab	$585,612	$510,851	$505,924	$571,874	$543,142	$2,717,403	-7.25%
Kane	Orderville	$76,539	$63,890	$64,437	$77,480	$73,366	$355,712	-4.15%

Source: Utah Office of Tourism (2013b).

In addition to traveler spending and tax revenues, travel- and tourism-related employment plays an important economic role in the SESA. Travel- and tourism-related jobs in the SESA were estimated at 5,118 in 2011 by the Utah Office of Tourism (2007–2010), a 72% increase over 2006 levels. Table 3.12.12 and Figure 3.12.4 show travel- and tourism-related employment numbers over time for the SESA, which have increased dramatically (in some cases more than doubling) since 2009 in all three counties.

Table 3.12.12. Travel- and Tourism-related Employment in the Socioeconomic Study Area 2006–2011

	2006	2007	2008	2009	2010	2011
Garfield	814	658	708	577	1,367	1,486
Iron	1,537	1,419	1,412	1,178	1,775	1,812
Kane	608	645	705	536	1,590	1,820
Combined SESA	2,959	2,722	2,825	2,291	4,732	5,118

Source: Utah Office of Tourism (2007-2010).

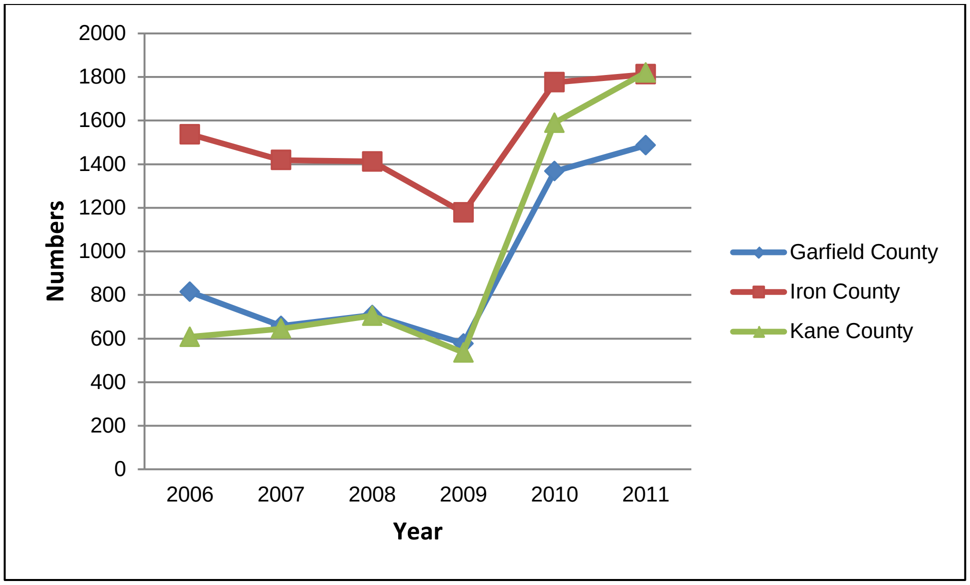

Figure 3.12.4. Travel- and tourism-related employment in the socioeconomic study area 2006–2011 (Utah Office of Tourism 2007-2010).

Although it is difficult to predict exactly how much tourists spend in an area on a given day, previous researchers have developed some estimates. A 1994 survey by Utah State University economists estimated visitor spending for southern Utah in general, for three wilderness areas, and for one WSA in southern Utah (Keith et al. 1995). Table 3.12.13 summarizes this study (visitors include general leisure visitors, business visitors, and recreationists to these four areas).

Table 3.12.13. Spending Estimates for Visitors to Southern Utah and Visitors to Southern Utah Wilderness Areas and Wilderness Study Areas

Area Visited	Expenditures Per Person Per Day (2011 dollars)
All visitors to southern Utah	$94
Visitors to three southern Utah wilderness areas and one WSA	$25–$34

Source: Keith and Fawson (1995).

Notes: Original data in 2001 dollars for southern Utah visitors and 1994 dollars for Utah wilderness area visitors. Adjusted to 2011 dollars using Consumer Price Index inflation values.

Southern Utah visitors are divided into those visiting for leisure purposes (74%) and those visiting for business purposes (26%).

The three Utah wilderness areas surveyed are Box-Death Hollow (Garfield County), Dark Canyon (San Juan County), and Paria Canyon (Kane County). Grand Gulch (San Juan County) is a WSA. These four areas in southern Utah are considered multi-day backpacking venues; therefore, the expenditures estimate may not be representative of day-use spending. Day-use spending can be higher because recreation day-use visitors may, for example, stay in motels, eat in restaurants, and purchase from local retailers. Also, these four areas are a mix of designated wilderness and WSAs.

Although the public lands in the SESA are not marketed, they do provide an economic and social value to local residents and tourists. Even if no money changes hands, visitors to the area and local residents find value and benefit by the presence of public lands because they provide satisfaction and unique opportunities. With specific regard to the SESA, the public lands that surround the town of Alton and other small communities contribute to the area’s rural, small-town feel. The local residents enjoy the area because of the pristine beauty and opportunities for solitude that the public lands provide. According to newer residents in towns in the SESA, the area’s peaceful lifestyle and slow pace was an attraction (SWCA 2007a). Thus, the public lands are of value to local residents and the tourists who enjoy the area.

Where relevant and feasible, the BLM directs to use estimates of nonmarket environmental values in NEPA analysis supporting planning and other decision making (BLM 2013b). Typically, nonmarket valuations have been used to estimate the monetary value individuals place on public lands. Nonmarket valuations view public lands in terms of their on-site value and their "passive" use or their off-site value. Economists have used data collected from actions or survey responses of visitors, homebuyers, and the public to simulate market conditions and elicit measures of value (Loomis 2005). The nonmarket value is the value received by the users and is above and beyond what they received for their direct expenditures. Table 3.12.14 presents average on-site use values for selected recreation activities that resemble public use activities near the Alton Coal Tract.

Table 3.12.14. Average Nonmarket Use Values of Recreation on Public Land from Existing Studies of Activities in the Intermountain Area

Recreation Type	Value Per Person Per Activity Day (2011 dollars)
Mountain Biking	$219.68
Float boating/rafting/canoeing	$80.62
Fishing	$59.03
Hunting	$57.81
General recreation	$57.71
Hiking	$45.88
Camping	$41.34
Picnicking	$33.66
Sightseeing	$28.08
Offroad vehicle driving	$27.16
Wildlife viewing	$44.34

Source: Loomis (2005).

Notes: Original data are in 2004 dollars and have been adjusted here to 2011 dollars using the Consumer Price Index inflation rate. All values are rounded to the nearest dollar. Data are median values from existing studies. The Inter-mountain area is considered USFS Regions 1–4. General recreation is a composite of recreation opportunities at a site with a measure for the site, not a specific activity.

In contrast to the on-site valuation of public lands, it is important to understand the passive-use valuation of public lands. Passive-use studies measure the satisfaction of knowing that undeveloped, primitive public land is simply "there" and will be preserved. A passive-use valuation study of Utah wilderness, completed more than 15 years ago, found that Utah residents placed an economic value of $82.46 per household (in 2011 dollars) on the preservation of the 2.7 million acres of designated wilderness in Utah (Loomis 2000). Although the lands within the proposed tract and surrounding areas are not designated wilderness areas, the example has been given to demonstrate the economic value of undeveloped, primitive landscapes. Although the economic value for passive use on public lands not containing a high level of wilderness characteristics would almost certainly be less than $82.46 per 2.7 million acres, the exact value households are willing to pay is unknown.

3.12.2 Government and Public Finance

3.12.2.1 REGIONAL COAL PRODUCTION

In 2011, Utah was ranked as the 14th highest coal-producing state, with 20.1 million tons of coal being produced in mines throughout Utah (Utah Geological Survey 2012), and 15th overall with 19 million tons according to the Ernst & Young 2013 report. Most Utah coal production occurs in Carbon, Emery, and Sevier counties. No coal production on BLM-administered land has occurred in Kane and Garfield counties since 1971 (2008d). However, 54% of the state's estimated remaining recoverable coal can be found in Kane County with 20.8% in Garfield County. Iron County has 1.7% of the state's coal reserves, with no coal mining currently occurring in the county (Utah Geological Survey 2013b).

3.12.2.1.1 Coal Royalty Revenues

Coal production on federal lands is subject to royalty payments and disbursements under the MLA. The royalty rate for surface mined coal is 12.5% of sales value and is paid to the Department of the Interior Office of Natural Resources Revenue (ONRR). These royalties are paid by mining companies to the federal government, which in turn dispenses approximately 50% to the State of Utah. Royalties received by Utah are distributed to several entities according to state law, most of which are allocated to UDOT (40%) and the Permanent Community Impact Fund (32.5%). The rest is allocated as follows: Department of Community and Culture (5.0%), State Board of Education (2.25%), Utah Geological Survey (2.25%), Water Research Laboratory (2.25%), and Payments in Lieu of Taxes (52¢ per acre).

In fiscal year 2012, over 13 million tons of coal were mined in Utah at a reported sales value of $521.3 million dollars. Of the total sales value, more than $65 million were reported in royalty revenues. Of this, approximately $36 million were disbursed to Utah. Bonus payment totaled $530.3 million in fiscal year 2012 (ONRR 2013).

3.12.2.1.2 Permanent Community Impact Fund Board

The Permanent Community Impact Fund Board (CIB) provides loans and/or grants to state agencies and subdivisions of the state that are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands. Projects eligible for funding include planning, construction, and maintenance of public facilities as well as provision of public services. Between fiscal years 2008 and 2012, Kane County received a total of $22,630,654 CIB funding ($4,107,654 in grants and $18,523,000 in loans). Of the 16 total projects funded by the CIB, one was in the town of Alton and two were in Kanab. Garfield County received a total of $13,652,000 in funds ($4,126,000 in grants and $9,526,000 in loans). Iron County received at total of $14,879,500 in CIB funding ($766,500 in grants and $14,113,000 in loans) (UDWS 2012).

3.12.3 Public Health and Safety

3.12.3.1 TRANSPORTATION

Principal transportation routes in the SESA are US-89, SR-14, SR-20, and I-15. US-89 runs from north to south through the towns of Panguitch, Hatch, and Kanab, and serves as the main access road to south-central Utah, including access between Bryce Canyon and Zion national parks.

UDOT has five roadway improvement projects along US-89 scheduled for completion in the next five years according to the *Statewide Transportation Improvement Plan 2008–2013*. The projects include construction of a passing lane from Milepost 88.3 to 89.1 (estimated cost: $1.4 million) and partial realignment and pavement rehabilitation from 300 North in Kanab to Kanab Creek Bridge (estimated cost: $10 million). In Garfield County, intersection improvements at US-89 and SR-14 (Long Valley Junction) are underway (estimated cost: $16 million) and road widening along US-89 is projected (estimated cost: $9 million) (2008).

In Kane, Garfield, and Iron counties, the county governments are responsible for ongoing road maintenance and repair. Special service districts undertake capital construction projects financed primarily by CIB funds. Local government assistance for road improvements includes Class B and Class C Road Funds programs as well as federal and state aid for specified projects.

3.12.3.2 LAW ENFORCEMENT

The Kane County Sheriff's Office employs 12 full-time law enforcement officers. They provide law enforcement services to the unincorporated areas of Kane County and several contract communities, including Alton. Kanab and Big Water have their own police departments.

Garfield County has one county sheriff, three deputy sheriffs, two Panguitch City police officers, two Utah Highway Patrol troopers, and one Escalante police officer. The sheriff's office has 21 volunteers from Panguitch, eight from Bryce Valley, and 19 from Escalante (FCAOG 1998).

The Iron County Sheriff's Department has 33 full-time officers, 18 of which are patrol officers. The department provides law enforcement to the unincorporated areas of the county and small cities including Summit, Paragonah, Kanarraville, and Newcastle. The jail is operated by the Iron County Sheriff's Department and employs 45 officers, one full-time bailiff, and five officers are part-time bailiffs. Several cities in Iron County have their own police departments, including Cedar City, Enoch, Parowan, and Brian Head. Southern Utah University in Cedar City also has its own police department (Evans 2008).

Crime in Kane County is considerably lower than the average for the State of Utah. In 2005, the crime rate per 1,000 people in Kane County was 11.77 (73 total index crimes) and Utah's crime rate per 1,000 was 40.35 (99,650 total index crimes). Index crimes are crimes against persons or property. There were 316 arrests made in Kane County in 2005. Larceny was the most reported crime with 44 reports, and aggravated assault was the second most reported crime with 17 reports. There were zero homicides and two reported rapes in the county in 2005 (UDPS 2005).

Garfield County's crime rate per 1,000 was 34.23. The index crime rate in 2005 was 153. The county had 116 reports of larceny. There were zero homicides and two reported rapes in 2005 (UDPS 2005).

The crime rate per 1,000 in Iron County was 28.24. The index crime rate in 2005 was 1,082. Larceny was also the most reported crime in Iron County with 753 reports. Approximately 1,656 arrests were made in the county. There was one homicide and 14 reported rapes in 2005 (UDPS 2005).

3.12.3.3 FIRE PROTECTION

Kane County has nine fire departments, including one located in the town of Alton. The Alton fire department has two fire trucks, zero paid fire fighters, and two volunteers (FCAOG 2007b).

Garfield County has 11 fire departments. Most fire departments are staffed by volunteers and have no paid firefighters; with the exception of Boulder Fire Department which has 14 paid firefighters and zero volunteers. The number of fire trucks per department range from one to four and the types of trucks range from structure and brush trucks, wildland trucks, Type 1 through 3 engines, and water tender trucks.

Iron County has nine fire departments operated primarily by volunteers. The Cedar City Fire Department has four paid employees and 35 active volunteers. The range and types of fire trucks available in Iron County are similar to those in Garfield County.

3.12.3.4 HEALTHCARE

Within the SESA, there are three hospitals that provide 24-hour emergency care and physician staffing. Kane County Hospital in Kanab is a 38-bed facility with two full-time physicians. Garfield Memorial Hospital in Panguitch is a 20-bed facility with three full-time physicians. Valley View Medical Center in Cedar City (Iron County) is a 48-bed facility (Hospital-Data.com 2009). Garfield Memorial and Valley View are operated by Intermountain Health Care. All three hospitals accept Medicaid and Medicare patients. There are also hospitals with 24-hour emergency services in St. George (approximately 100 miles south of Alton) and Richfield (approximately 115 miles north of Alton). These hospitals are equipped to handle acute medical and trauma conditions, and air transport via Air-Med (University of Utah) or Life Flight (Intermountain Health Care) can provide emergency service to hospitals further away.

Numerous Intermountain Health Care healthcare clinics are available in the SESA, including Panguitch, Cedar City, Circleville, Escalante, Cannonville, and Orderville. The clinics provide family and internal medicine, pediatrics, lab, x-ray services, etc.

3.12.3.5 AMBULANCE

Ambulance services are provided via local counties. Kane County Ambulance is operated out of Kanab. Garfield County Ambulance is in Panguitch. Iron County Ambulance is in Parowan.

3.12.4 Environmental Justice

3.12.4.1 EXECUTIVE ORDER BACKGROUND AND REGULATORY GUIDANCE

EJ refers to the fair and equitable treatment of individuals regardless of race, ethnicity, or income level, in the development and implementation of environmental management policies and actions. In February 1994, President Clinton issued EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low Income Populations*. The objective of this EO is to require each federal agency to “make achieving EJ part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low income populations” (EO 12898). The EPA has an agency mandate to steward EJ and has an EJ goal for all citizens of the United States. The EPA states that its EJ goal will be achieved when “everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work” (EPA 2013b).

Convened under the auspices of the EO, the Interagency Working Group defines Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut and other nonwhite persons as minority populations. Low-income populations are defined as persons living below the poverty level based on their total income.

The EPA defines a community with potential EJ populations as one that has a greater percentage of minority or low-income populations than an identified reference community. The standard for identifying minority populations is either 1) the minority population of the affected area exceeds 50% or 2) the minority population percentage of the affected area is “meaningfully greater” than the minority population percentage in the general population or other appropriate unit of geographic analysis, such as a reference community (CEQ 1997). The EPA has not specified what percentage of the population can be characterized as “meaningfully greater” in order to define an EJ population. To address this and other questions, a small working group comprising the EPA and the BLM was convened to discuss the question and to respond to comments from the EPA on the DEIS. As a result of these discussions, the BLM and the EPA agreed that for the purposes of this analysis, an EJ population of concern would be identified if the community's minority and/or poverty status was greater than that of the reference community.

The area of analysis used to identify the potential EJ populations included census tracts and communities along the reasonably foreseeable coal haul transportation route. Towns and census tracts along the reasonably foreseeable coal haul route (segments of I-89, SR-14, SR-20, I-15, and SR-56) were identified as units of measurement for potential EJ communities, and the reference community chosen for these units was the county within which the town or census tract lies (Iron, Garfield, and Kane counties). These communities' poverty and minority rates were analyzed against those of their respective counties. This analysis uses Census Bureau American Community Survey (ACS) five-year estimates for the 2007–2011 period for poverty levels and 2010 Census Demographic Profile Data for minority status. These data were chosen to cover both poverty and minority topics over the three different geographic areas (counties in the SESA, census tracts along the reasonably foreseeable coal haul route, and towns along the coal haul route). Communities along the reasonably foreseeable coal haul transportation route that were identified as EJ populations are shown in Tables 3.12.15, 3.12.16, 3.12.18 and 3.12.19 and are discussed below.

3.12.4.2 POVERTY RATES

The first element of concern in the study of EJ is the potential for actions (taken or not taken) to cause disproportionate impacts to low income populations. Low income populations are characterized as those living below the poverty level. In 2010, the poverty level established by the census for a family of four (with two related children under age 18) was $22,113 (U.S. Census Bureau 2013f). In 2012, the poverty level for the same household increased to $23,283. The tables below identify EJ populations in counties in the SESA, census tracts along the reasonably foreseeable coal haul route, and towns along the reasonably foreseeable coal haul route living below the poverty level as compared to their respective reference communities. The reference community used for each census tract and town was the county within which each unit resides. The State of Utah poverty level is included for reference.

Tables 3.12.15 and 3.12.16 show identified impoverished EJ communities in the census tracts and towns along the reasonably foreseeable coal haul transportation route and near the tract. Census tracts and towns with percentages of individuals living below the poverty level of their respective reference community (counties) have shaded cells (reference community values are underlined). Towns within each census tract are listed in Table 3.12.15 for reference.

Table 3.12.15. Percentage Living Below the Poverty Level in Census Tracts along the Reasonably Foreseeable Coal Haul Route and near the Tract

	State of Utah	Iron County									Garfield County		Kane County	
Reference community/ census tract number	–	Iron County Proper (reference community)	1101	1102	1103	1104	1105	1106	1107.01	1107.02	Garfield County Proper (reference community)	3	Kane County Proper (reference community)	1301
Towns in census tract	–	–	Paragonah, Parowan, Summit	Cedar City, Enoch	Cedar City	Cedar City	Cedar City	Cedar City	Cedar City	Cedar City	–	Panguitch, Hatch	–	Alton
Percentage living below poverty level	11.4%	20.7%	7.5%	18.4%	31.5%	22.0%	28.6%	21.2%	11.6%	24.7%	14.2%	15.6%	8.3%	15.2%

Source: U.S. Census Bureau (2007–2011b).

Table 3.12.16. Percentage Living Below the Poverty Level in Towns along the Reasonably Foreseeable Coal Haul Route and near the Tract

County	State of Utah	Iron County						Garfield County			Kane County	
Town		Iron County Proper (reference community)	Cedar City	Paragonah	Parowan	Summit	Enoch	Garfield County Proper (reference community)	Panguitch	Hatch	Kane County Proper (reference community)	Alton
Percentage living below poverty level	11.4%	20.7%	22.6%	10.1%	7.8%	0.0%	16.3%	14.2%	20.0%	1.8%	8.3%	35.6%

Source: US Census Bureau (2007–2011b).

Note: No data available for Iron Spring or Long Valley Junction.

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Tables 3.12.15 and 3.12.16 show EJ communities in census tracts as follows: census tract 3 in Garfield County; census tracts 1103, 1004, 1005, 1106, and 1107.02 in Iron County; and census tract 1301 in Kane County. Towns identified as EJ communities are Panguitch, Cedar City, and Alton. Because EJ communities were identified, an analysis to address resource impacts to these communities is carried forward in Chapter 4.

3.12.4.3 RACE AND ETHNICITY

Overall, the SESA has a greater percentage of whites and a lower percentage of other races than the State of Utah as a whole. Also, the state population as a whole has more than double the Hispanic population of Kane, Garfield, and Iron counties. Information regarding racial and ethnic composition in the SESA is provided in Table 3.12.17.

Table 3.12.17. Race Percentages in the Socioeconomic Study Area

Location	White	Hispanic or Latino	Black or African American	American Indian and Alaska Native	Asian or Pacific Islander	Other/Two or More Races
Garfield County	94.1%	4.5%	0.4%	1.6%	1.4%	2.5%
Iron County	90.7%	7.7%	0.5%	2.2%	1.1%	5.6%
Kane County	95.7%	3.7%	0.2%	1.5%	0.4 %	2.2%
SESA average	93.5%	5.3%	0.4%	1.8%	1.0%	3.4%
State of Utah	**86.1%**	**13.0%**	**1.1%**	**1.2 %**	**2.9%**	**8.7%**

Source: U.S. Census Bureau (2013b).

As stated earlier, a community or census tract is considered as having a potential EJ population if the population that falls within the category exceeds the percentage in the reference community, which is the county within which a town or census tract is located. As indicated in Table 3.12.17, the American Indian and Alaska Native population in each county in the SESA is greater than the reference population (State of Utah).

Tables 3.12.18 and 3.12.19 below show identified minority EJ communities in the census tracts and towns along the reasonably foreseeable coal haul transportation routes and near the tract. Census tracts and towns with higher percentages of minority populations than their respective reference communities are underlined. State of Utah minority population levels are included for reference. Reference community values are shown in shaded cells. Towns within each census tract are listed in Table 3.12.18 for reference.

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Table 3.12.18. Minority Percentages in Census Tracts along the Reasonably Foreseeable Coal Haul Route and near the Tract

	State of Utah	Iron County									Garfield County		Kane County	
Census tract number	–	Iron County Proper (reference community)	1101	1102	1103	1104	1105	1106	1107. 01	1107. 02	Garfield County Proper (reference community)	3	Kane County Proper (reference community)	1301
Towns in census tract	–	–	Paragonah, Parowan, Summit	Cedar City, Enoch	Cedar City	Cedar City	Cedar City	Cedar City	Cedar City	Cedar City	–	Panguitch, Hatch	–	Alton
Hispanic or Latino	13.0%	7.7%	5.5%	7.2%	10.5%	4.8%	11.9%	6.5%	6.2%	6.2%	4.5%	3.3%	3.7%	2.9%
Black or African American	1.1%	0.5%	0.2%	0.1%	0.3%	1.1%	0.5%	0.7%	0.8%	0.3%	0.4%	0.5%	0.2%	0.2%
American Indian and Alaska Native	1.2%	2.2%	0.6%	1.6%	1.6%	1.5%	4.6%	2.6%	1.3%	1.5%	1.6%	1.5%	1.5%	2.7%
Asian or Pacific Islander	2.9%	1.1%	0.4%	0.8%	0.7%	1.2%	0.9%	1.3%	1.5%	1.5%	1.4%	0.6%	0.4%	0.7%
Other/Two or More Races	8.7%	5.6%	3.5%	5.2%	7.1%	4.1%	9.1%	2.7%	3.9%	3.4%	2.5%	1.7%	2.2%	2.0%

Source: U.S. Census Bureau (2013b).

Table 3.12.19. Minority Percentages in Towns along the Reasonably Foreseeable Coal Haul Route and near the Tract

Minority Percentages	State of Utah	Iron County						Garfield County			Kane County	
	–	Iron County Proper (reference community)	Cedar City	Paragonah	Parowan	Summit	Enoch	Garfield County Proper (reference community)	Panguitch	Hatch	Kane County Proper (reference community)	Alton
Hispanic or Latino	13.0%	7.7%	7.9%	2.9%	4.8%	8.1%	6.7%	4.5%	3.0%	0.8%	3.7%	5.0%
Black or African American	1.1%	0.5%	0.7%	0.0%	0.2%	0.0%	0.1%	0.4%	0.7%	0.0%	0.2%	0.0%
American Indian and Alaska Native	1.2%	2.2%	2.7%	0.2%	0.6%	3.1%	1.6%	1.6%	2.0%	0.0%	1.5%	2.5%
Asian or Pacific Islander	2.9%	1.1%	1.2%	0.2%	0.2%	0.0%	0.9%	1.4%	0.5%	0.8%	0.4%	2.5%
Other/Two or More Races	8.7%	5.6%	6.0%	3.0%	2.3%	4.4%	4.7%	2.5%	1.6%	0.8%	2.2%	5.9%

Source: U.S. Census Bureau (2013b).

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Tables 3.12.18 and 3.12.19 show several minority populations at the census tract or town scale that exceed that of their respective counties, and were therefore identified as EJ communities. In Garfield County, EJ communities were identified in census tract 3 and Panguitch due to minority population percentages of African American, American Indian and Alaska Native, and Asian/Pacific Islander groups that exceed the county levels. Iron County has multiple minority populations exceeding county levels in both Cedar City and Summit, in addition to the following census tracts: 1103, 1004, 1005, 1106, 1107.01, and 1107.02 (see Tables 3.12.18 and 3.12.19). In the Town of Alton, all minority group population percentages except African Americans exceed Kane County levels. Impacts analyses are carried forward in Chapter 4 to address resource impacts to identified EJ communities.

3.12.4.4 NATIVE AMERICAN BASELINE HEALTH DATA

According to Utah Office of Public Health Assessment (2005), Utah's American Indian/Alaska Natives population suffers disproportionally from the prevalence of chronic diseases or conditions such as arthritis, asthma, coronary heart disease, diabetes, and poor mental health, as outlined for specific conditions in Table 3.12.20.

Table 3.12.20. Native American Baseline Health Statistics for Utah

Chronic Disease or Condition*	Utah American Indian/Alaska Natives	All Utahns	Disparity
Arthritis	32.2%	23.8%	+ 8.4%
Asthma	11.4%	5.5%	+ 5.9%
Coronary heart disease	8.7%	4.5%	+ 3.3%
Diabetes	8.0%	4.5%	+ 3.5%
Poor mental health	22.9%	15%	+ 7.9%

Source: Utah Department of Health (2005, 2009).

* Prevalence, not deaths from, which is a different statistic available only for diabetes and coronary heart disease.

Table 3.12.20 shows that Utah American Indian/Alaska Natives suffer disparities in incidence of chronic diseases and conditions within their population as compared to the greater population of Utah; this disparity ranges from over 3% for coronary heart disease and diabetes, to nearly 6% higher rates of asthma, and finally an approximately 8% and 8.5% increase in poor mental health and arthritis, respectively (Utah Department of Health 2005).

3.13 Soils

The analysis area for soils is the tract and the reasonably foreseeable coal haul transportation route. Soils are the medium for plant growth and provide nourishment for nearly all terrestrial organisms. They support a number of vegetation and animal communities in the Alton Coal Tract. The following section describes the soils that occur in the tract, as categorized by the soil survey conducted as part of the 1987 UII PAP (UII 1987b). The soil conditions described below are shown on Maps 3.13 and 3.14. Soils in the tract are derived primarily from sedimentary geologic deposits that occur throughout the region, including the Tropic Shale (61% of the tract) and Dakota Sandstone (16% of the tract) deposits (UII 1987b). A variety of soil types exists in the tract, including highly saline and highly erodible soils (UII 1987b). Soils that are highly saline, highly erodible, and have low water-holding capacity (drought intolerant) may be especially vulnerable to impacts and may be harder to reclaim or restore after disturbance. Biological soil crusts are unambiguously effective in reducing wind and water erosion of the soil surface (BLM 2011b). Disturbance of biological soil crusts affects most soils, but depending on the type of soil and biotic community, some are affected more than others.

Soils along the reasonably foreseeable coal haul transportation route are similar to the soils found in the tract, derived primarily from sedimentary geologic deposits such as Tropic Shale and Dakota Sandstone. Soils within a 100-foot buffer of the reasonably foreseeable coal haul transportation route are affected by current vehicle traffic along this route. The deposition of road dust and vehicle exhaust can affect the chemical composition of soils over time, affecting soil productivity.

3.13.1 Sensitive Soils

Sensitive soils have characteristics that make them more susceptible to impacts or more difficult to restore or reclaim after disturbance. These characteristics consist of moderate to high salinity, low nutrient levels, high runoff potential, and limitations to grazing, susceptibility to high wind or water erosion; or occurring on very steep slopes that are more susceptible to erosion. In this EIS, a sensitive soils designation refers to highly erodible soils, saline soils, drought intolerant soils, sodic soils, shallow soils (limited rooting depth), alkaline soils, and biological soil crusts. Sensitive soils are difficult to reclaim or restore, and once disturbed, the impact is usually long term. Table 3.13.1 shows the risk factors used to determine the sensitivity of soil units mapped for the UII PAP in 1987 (UII 1987b). The table shows the specific factors used to determine the risk of rehabilitation restrictions for soils in the tract. Table 3.13.2 shows the number of acres in the tract that are at risk for restricted soil rehabilitation due to a number of restrictive soil features.

Table 3.13.1. Soil Rehabilitation Restrictions and Reclamation Risks

Factors	High Risk	Moderate Risk	Low Risk	Restrictive Feature
Erodibility				
Water erosion hazard (from 1987 survey)[*]	High	Moderate	Slight to Moderate	Water erosion hazard
Limits on Reclamation				
Available water capacity (inches)[†]	< 4	4–6	> 6	Droughty soils
Salinity[‡] (mmhos/cm; surface layer)[¥]	> 16	8–16	< 8	Excess salt
Sodium adsorption ratio[§] (surface layer)[¥]	> 13	4–13	< 4	Excess sodium
Depth to C horizon (inches)[¥]	< 10	10–20	> 20	Rooting depth
Alkalinity (pH of surface layer)[¥]	> 9.0	7.8–8.9	< 7.8	Excess alkalinity

[*] Water erosion hazard was rated for bare soil areas based on inherent soil characteristics, such as texture, permeability, soil aggregate stability, and strength of soil structure.

[†] Maximum value for the range of available water capacity for the soil layer given as inches of water per 36 inches of soil.

[‡] Maximum value for the range in soil salinity; mmhos/cm is the units of millimhos per centimeter and is a measure of electrical conductivity that is used to describe soil salinity.

[¥] Draft parameters developed by the BLM's National Science and Technology Center, Soil Survey Geographic database (SSURGO) soils mapping.

[§] Maximum value for the range in sodium adsorption ratio; sodium adsorption ratio is a measure of the ratio of the sodium to the calcium and magnesium in a soil.

Table 3.13.2. Acres (and percentage) of the Alton Coal Tract At Risk of Restricted Soil Rehabilitation

Restrictive Feature	High Risk	Moderate Risk	Low Risk
Erodibility			
Water erosion hazard	843 (23.6%)	2,515 (70.3%)	218 (6.1%)
Limits on Reclamation			
Droughty soils	627 (17.5%)	182 (5.1%)	2,768 (77.4%)
Excess salt	0 (0.0%)	0 (0.0%)	3,577 (100.0%)
Excess sodium	4 (0.1%)	0 (0.0%)	3,498 (97.8%)
Rooting depth (shallow soils)	2,872 (80.3%)	693 (19.4%)	12 (0.3%)
Excess alkalinity	0 (0.0%)	416 (11.6%)	3,161 (88.4%)

Notes: Because some soil units had missing data, risk factors may not total to 100% of the tract acreage.

3.13.1.1 WATER-EROSIVE SOILS

Water-erosive soils have naturally high rates of erosion; however, the erosion rates are easily accelerated by surface-disturbing activities. In all, 843 acres of soils with a high risk of erodibility occur on the tract (23.6% of the tract). Soils with a moderate risk of erodibility occur on 2,515 acres or 70.3% of the tract. Soils with a low risk of erodibility occur on 218 acres or 6.1% of the tract. A soil's potential for water erosion was estimated based on inherent soil characteristics such as soil texture, permeability, aggregate stability, and the strength of the soil structure (UII 1987b). Observations of erosion in mapped soil units were also used to determine their risk for erosion. Accelerated erosion forms rills and gullies, and can contribute to excess sedimentation in streams and reservoirs. In addition, erosion reduces natural revegetation and the effectiveness of vegetation restoration efforts by removing topsoil, washing away plant seeds and propagules, and burying or damaging existing plants.

3.13.1.2 DROUGHT-INTOLERANT SOILS

Certain soil types are more sensitive to negative impacts during drought conditions. A number of soil units on the tract have a low available water capacity due to soil structure and composition (UII 1987b); thus, these high risk soils and their associated vegetation may be severely affected by drought. Severe drought may adversely affect the production of perennial vegetation. Soils at high risk for poor reclamation occur over 627 acres, or 17.5%, of the tract. Areas at moderate risk occur over an additional 182 acres, or 5.1% of the tract. Areas with a low risk occur over 2,768 acres, or 77.4% of the tract.

3.13.1.3 SALINE SOILS

Soil salinity can influence the downstream effects of erosion and the reclamation potential of an area's soils. Highly saline soils limit the diversity of vegetation species that can be established on a site, and at very high levels, they may inhibit the establishment of even halophytic (salt-loving) plants. Erosion of saline soils impacts the water quality of downstream watersheds. Highly saline soils are soils with electrical conductivity levels of greater than 16 millimhos per centimeter (mmhos/cm). Moderately saline soils fall between 8 and 16 mmhos/cm. The tract contains only soils with electrical conductivity levels of less than 8 mmhos/cm, or low salinity.

3.13.1.4 SODIC SOILS

High sodium levels can affect the reclamation potential of disturbed soils by inhibiting the establishment of vegetation. Four acres (or 0.1%) of the Alton Coal Tract are highly sodic, or have a sodium adsorption ratio of greater than 13 mmhos/cm. The rest of the tract has a low risk of sodic soils, or a sodium adsorption ratio of less than 4 mmhos/cm.

3.13.1.5 SHALLOW SOILS

A shallow topsoil layer (or A horizon) limits a plant’s ability to root deeply. It may inhibit an area's restoration potential because of its limited depth, water holding capacity, and nutrients available for plant establishment. Rooting depth, or depth to the C horizon of the soil, affects restoration potential because plant root growth does not occur below the upper (A and B) soil horizons. The C horizon of the soil is characterized by unweathered parent material and generally does not support the biological activity necessary for soil development. It is assumed for this analysis that soils with an A horizon of less than 10 inches are at high risk for poor reclamation (based on draft parameters developed by the BLM's National Science and Technology Center). These soils occur over 2,872 acres, or 80.3%, of the tract. Areas at moderate risk (or with a rooting depth of 10–20 inches) occur over an additional 693 acres, or 19.4% of the tract. Areas with a low risk (a rooting depth greater than 20 inches) occur over 12 acres, or 0.3% of the tract.

3.13.1.6 ALKALINE SOILS

Alkalinity refers to soil pH. High pH, or an alkaline condition, generally limits a plant’s ability to establish itself. A number of soil units on the tract are moderately alkaline (UII 1987b). Approximately 416 acres of the tract have moderately alkaline conditions (11.6%), and 3,161 acres (88.4%) have a low risk of reclamation restriction due to alkalinity.

3.13.1.7 BIOLOGICAL SOIL CRUSTS

Some of the dominant vegetative communities in the tract, such as pinyon-juniper and sagebrush communities, have evolved with the presence of biological soil crusts. Biological soil crusts are made up of mats or filaments of cyanobacteria, lichens, and mosses. Development of biological soil crust is strongly influenced by soil texture, soil chemistry, and soil depth. Crusts are more developed in shallow, sandy, nonsaline soils. Biological soil crusts play a major role in reducing water and wind erosion and in preventing the establishment of invasive annual grasses (BLM 2011b). They fix atmospheric nitrogen and carbon, retain soil moisture, and provide surface cover. Crust composition and level of abundance can be used to determine the ecological history and condition of a site (BLM 2011b).

Loss of biological soil crust leads to reduced soil productivity, decreased plant cover and vigor, and increased wind and water erosion. Severity, size, frequency, and timing of a surface-disturbing activity affect the degree of impacts to biological soil crusts, as well as vascular plant community structure, adjoining substrate condition, inoculation material availability, and climate during and after a disturbance. Fine-textured soils have faster crust recovery rates than coarse-textured soils (BLM 2011b). In the scientific literature, recovery rates have ranged widely (two to more than 3,800 years) and either appear to show no pattern or often appear contradictory. However, general recovery times can be predicted for soil crusts in different environments. During studies on the Colorado Plateau, cyanobacterial cover has recovered within 14–34 years (BLM 2011b). Assuming adjoining soils are stable and rainfall is average, recovery rates for lichen cover in southern Utah have been estimated at a minimum of 45 years, whereas recovery of moss cover was estimated at 250 years (Belnap et al. 1997). The distribution of soil crusts in the tract is unknown. Approximately 1,430 acres (40.2%) of the tract have soils associated with pinyon-juniper vegetation, which is often associated with biological soil crusts. An additional 1,609 acres (45.0%) of the tract have soils associated with sagebrush, which is also associated with soil crusts.

The inoculation of biological soil crusts is used to speed up the recovery of biological soil crusts and soil reclamation. Recent scientific research has involved field testing of the inoculation of reclaimed soils with biological soil crusts (improved with sand barriers) over a three-year time period. Results show that cyanobacterial and algal cover climbed up to 48.5%, and 14 cyanobacterial and algal species were identified at the end of the inoculation experiment (W. Wang et al. 2009). In addition, biological crusts' thickness, compressive strength, and chlorophyll *a* content increased with inoculation time over three years; moss species appeared in the second year; cyanobacterial inoculation increased organic carbon and total nitrogen of the soil; and total salt, calcium carbonate, and electrical conductivity in the soil also increased after inoculation (W. Wang et al. 2009). The study concludes that cyanobacterial inoculation would be a suitable and effective technique to recover biological soil crusts, and may further restore the ecological system.

3.14 Transportation

3.14.1 Regional Overview

The transportation analysis area is the tract and reasonably foreseeable coal haul transportation route. Existing vehicle traffic in and near the tract and reasonably foreseeable coal haul transportation route consists of local residents; tourists to Bryce Canyon National Park, the Dixie National Forest, and public lands; and commercial truck traffic. Transportation infrastructure associated with the tract and reasonably foreseeable coal haul transportation route would include numerous unimproved, dirt access roads and two-track trails, KFO Route 116, US-89, SR-20, I-15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is west of Cedar City, Utah. It is the nearest railroad facility to the tract. Current transportation facilities along the coal truck haul route can be found in Appendix H.

3.14.2 Existing Traffic Conditions on the Reasonably Foreseeable Coal Haul Transportation Route

Existing traffic conditions for both roadways and intersections along the reasonably foreseeable coal haul transportation route are quantified using a level of service (LOS) measurement. LOS is a measure of the quality of service on transportation infrastructure and generally indicates the level of traffic congestion. LOS on two-lane highways is a reflection of traffic flow conditions, average speed, and average time spent following other vehicles. LOS at intersections reflects the amount of congestion and delay experienced by motorists at intersections. LOS is rated on a scale of A (the best) to F (the worst). LOS-A on roadways occurs where traffic flows are at or above posted speed limits and where drivers have complete mobility between lanes. LOS-A at intersections occurs when drivers take less than 10 seconds to pass through an intersection. LOS-F occurs when the vehicle traffic flow exceeds the road segment capacity (Fehr & Peers Transportation Consultants 2013). Table 3.14.1 includes a description of LOS-A through LOS-F (Fehr & Peers Transportation Consultants 2013).

Table 3.14.1. Intersection Level of Service Descriptions

LOS	Description of Traffic Conditions
A	Free Flow/Insignificant Delay Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.
B	Stable Operations/Minimum Delays Good progression. The presence of other users in the traffic stream becomes noticeable.
C	Stable Operations/Acceptable Delays Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.
D	Approaching Unstable Flows/Tolerable Delays Marginal progression. Operating conditions are noticeably more constrained.
E	Unstable Operations/Significant Delays Can Occur Poor progression. Operating conditions are at or near capacity.
F	Forced Flows/Unpredictable Flows/Excessive Delays Unacceptable progression with forced or breakdown of operating conditions.

Source: Fehr & Peers Transportation Consultants (2013).

KFO Route 116 is the main graded dirt road that travels north–south through the tract. It becomes a paved, two-lane road from the town of Alton west to US-89. LOS data are not available for KFO Route 116. US-89 is a north–south highway that passes through the towns of Hatch and Panguitch. Most of US-89 is a two-lane highway, with passing lanes on steep climbs and a four-lane section in Panguitch. The speed limit is posted at 65 miles per hour (mph) in the area of analysis, except in Hatch and Panguitch where it is reduced to 40 mph, and 35 mph, respectively. Four of the intersections in the transportation area of analysis occur on US-89 at SR-14, SR-12, south of SR-20, and SR-20. SR-12 is the main access road from US-89 east to Red Canyon (in the Dixie National Forest) and to Bryce Canyon National Park. None of these intersections have traffic signals.

SR-20 is an east–west state road that connects US-89 and I-15. SR-20 is a paved, two-lane road with a climbing lane on steep sections approaching the summit. The speed limit is posted at 60 mph from the junction with US-89 to the steep upgrade, 35 mph climbing the upgrade to the summit, and back to 65 mph from the summit to I-15.

I-15 is a four-lane, divided, interstate freeway that runs north–south through Utah. Along the reasonably foreseeable coal haul transportation route, I-15 has posted speed limits of 75 mph from SR-20 to Cedar City.

SR-56 is an east–west state road from Cedar City to the Nevada state line. SR-56 varies from four lanes through Cedar City to two lanes outside the city. The only intersection with a traffic signal along the reasonably foreseeable coal haul transportation route occurs at I-15 and SR-56. SR-56 has a posted speed limit of 45 mph on the reasonably foreseeable coal haul transportation route.

Existing conditions along the reasonably foreseeable coal haul transportation route consist of low volumes of traffic generally moving at free-flow speeds. Haul route segments along US-89 and SR-20 operate at LOS-C or better during weekday and weekend traffic in both directions. LOS-C occurs on roadways at or below capacity where posted speed limits are easily maintained, but the ability to pass or change lanes is not always assured. The existing LOS along the directional segments of I-15 and SR-56 was not measured as part of the Fehr and Peers study (Fehr & Peers Transportation Consultants 2013).

Existing conditions at intersections along the reasonably foreseeable coal haul transportation route include low delays per vehicle and little to no congestion. The four unsignalized intersections along US-89 operate at LOS-A during peak morning and peak evening hours. Although LOS was not measured on directional segments of I-15 and SR-56, the signalized intersection at SR-56 and I-15 operates at LOS-C or better during peak morning and peak evening hours (Fehr & Peers Transportation Consultants 2013).

A 2003–2005 study of vehicle accidents across the reasonably foreseeable coal haul transportation route was prepared by UDOT (Fehr & Peers Transportation Consultants 2013). The study generated a three-year crash history for US-89, SR-20, I-15, and SR-56. The study shows that the predominant crash type across all four segments is the single vehicle, accounting for 81.2% of accidents along US-89, 86.1% of all accidents along US-20, 77.6% of all accidents along I-15, and 48.3% of all accidents along SR-56. Single-vehicle accidents along the haul route were wildlife or domestic animal related, or involved drivers running off the road because of excessive speed, weather, falling asleep, and driving under the influence. Most multi-vehicle accidents involved rear-end crashes from following too closely, and sideswipe crashes from attempting to pass under unsafe conditions (Fehr & Peers Transportation Consultants 2013).

3.15 Vegetation

3.15.1 Regional Overview

The analysis area for vegetation is the tract, reasonably foreseeable coal haul transportation route, and the area immediately adjacent to the tract and transportation route, because the potential impacts to vegetation from the proposed pit disturbance, facilities construction, coal hauling, and road relocation are not expected to extend beyond this area. Kane County is in the Colorado Plateau Semidesert Province (USFWS 1996) of south-central Utah. The Alton Coal Tract occurs in the semiarid foothills of this ecoregion (Woods et al. 2001b). Vegetation communities on the tract are typical of what is found in the surrounding Colorado Plateau region, namely pinyon-juniper woodlands, sagebrush shrublands, and mountain brush communities. Details of vegetation communities in the tract are presented in the sections below. Sources followed for identifying the scientific nomenclature in this section include the U.S Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) PLANTS Database (NRCS 2013) and Welsh et al. (2003).

Mean annual precipitation in the town of Alton was approximately 16.7 inches from 1915 to 2013, and mean annual maximum temperature for this same period was 60.0°F (WRCC 2013). The Colorado Plateau province receives precipitation in a bimodal pattern; precipitation occurs in the form of snow during the winter months and in the form of monsoonal storms in late summer (West et al. 2000). The Alton area also receives its annual precipitation in a bimodal pattern (WRCC 2006). The climate of the Colorado Plateau supports plant species that are physiologically adapted to withstand drought and heat, such as through leaf texture, surface-area, and specialized photosynthetic processes (Willson et al. 2008).

Vegetation on public lands in the tract is managed by the BLM in accordance with the KFO RMP (BLM 2008b). Vegetation treatment and management on public lands would provide measures to maintain or improve the overall health of vegetation communities (BLM 2008b). Specific management for vegetation would target forests and woodlands, uplands, and riparian and wetland communities through implementation of controls on noxious and invasive weed species and application of *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). Vegetation treatments would consist of prescribed fire, mechanical, chemical and biological treatments, woodland product removal, and wildland fire.

Vegetation communities along the reasonably foreseeable coal haul transportation route are similar to the vegetation communities found in the tract. Vegetation within a 100-foot buffer of the reasonably foreseeable coal haul transportation route is affected by current vehicle traffic along this route. Road dust and vehicle exhaust inhibit stomatal function and photosynthesis (Hirano et al. 1995), and therefore impact overall plant health.

3.15.2 Vegetation Communities in the Tract

The analysis area for vegetation is the tract, because the potential impacts from proposed mining activities, including surface disturbance from pit disturbance, facilities construction, and road relocation, would be limited to the tract. The analysis area also includes the reasonably foreseeable coal haul transportation route, because road dust, coal dust, and vehicle dust have the potential to affect vegetation near the route. Vegetation communities in the tract are pinyon-juniper woodland, mountain brush, meadow, rabbitbrush, riparian, sagebrush/grassland, and sagebrush/grassland (treated) (USFWS 1996). Pinyon-juniper woodlands include transition zones between this and other communities; pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush combinations also occur under this heading. Agricultural meadows and pastures on private surface lands are also found in the tract. Ecologists surveyed the tract in fall of 2007 to determine the specific locations and acreages of these communities (Table 3.15.1; Map 3.15). The tract had also been previously surveyed by Mt. Nebo Scientific in 2007. Descriptions of these vegetation communities and lists of dominant species are presented in the sections below.

Table 3.15.1. Vegetation Community Acreages in the Alton Coal Tract

Vegetation Community	Acres	Percentage of the Tract*
Pinyon-juniper woodland	1,430.0	40.2%
Pinyon-juniper/mountain brush	438.8	–
Pinyon-juniper/sagebrush	506.0	–
Pinyon-juniper/sagebrush/mountain brush	485.2	–
Sagebrush/grassland	860.2	24.1%
Sagebrush/grassland (treated) †	749.1	20.9%
Annual and perennial grasses (pasturelands)	324.1	9.1%
Mountain brush	62.8	1.8%
Meadow	62.8	1.8%
Irrigated wet meadow wetland	31.6	–
Riparian	55.3	1.5%
Riparian wet meadow wetland	18.5	–
Mixed riparian scrub-shrub/wet meadow wetland	3.8	–
Rabbitbrush	10.7	0.3%
Total	**3,555.0**	**99.4%**

* Unvegetated areas consist of 4.1 acres of open water and 17.4 acres of roads, or approximately 0.6% of 3,576.6 acres in the tract.

† Mechanically treated to remove encroaching pinyon pine and Utah juniper and seeded to restore forb and grass cover.

3.15.2.1 PINYON-JUNIPER WOODLAND

Pinyon-juniper woodland (1,430 acres) accounts for the greatest percentage of land in the tract (40%). For the purposes of the reconnaissance surveys, all vegetation communities with pinyon pine (*Pinus edulis*) or Utah juniper (*Juniperus osteosperma*) trees as a dominant component of the overstory are considered to belong to the pinyon-juniper woodland community or one of its combinations (i.e., pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, or pinyon-juniper/sagebrush/mountain brush). The pinyon-juniper woodland community discussed here is also identified as the Colorado Plateau Pinyon-Juniper Woodland cover class in the SWReGAP land cover database (Lowry et al. 2007).

Understory species in pinyon-juniper woodlands include shrubs, grasses, and forbs that are also commonly found in other vegetation communities in the tract. Shrub species include black sagebrush (*Artemisia nova*), Gambel oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), alder-leaf mountain mahogany (*Cercocarpus montanus*), wild crab apple (*Peraphyllum ramosissimum*), antelope bitterbrush (*Purshia tridentata*), broom snakeweed (*Gutierrezia sarothrae*), and snowberry (*Symphoricarpos oreophilus*). Grass and forb species include slender wheatgrass (*Elymus trachycaulus*), daisy (*Erigeron* spp.), buckwheat (*Eriogonum* spp.), and fescue (*Festuca* spp.). Cacti species include prickly pear (*Opuntia* spp.) and echinocactus (*Echinocereus* spp.).

3.15.2.2 MOUNTAIN BRUSH

Mountain brush accounts for 62.8 acres (1.8%) of land in the tract and occurs mainly in ravines and hillsides. Gambel oak is the dominant overstory species in this community. The mountain brush community discussed here is also identified as the Rocky Mountain Gambel Oak-Mixed Montane Shrubland cover class in the SWReGAP land cover database (Lowry et al. 2007). Understory shrubs identified in this community are black sagebrush, big sagebrush (*Artemisia tridentata*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), rubber rabbitbrush (*Ericameria nauseosa*), Utah juniper, Rocky Mountain juniper (*Juniperus scopulorum*), pinyon pine, antelope bitterbrush, Woods' rose (*Rosa woodsii*), and snowberry. Grass and forb species in this community are crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and prickly pear cactus (*Opuntia* spp.).

3.15.2.3 ANNUAL AND PERENNIAL GRASSES

Agriculture is practiced, or has historically been practiced, on 324 acres (9.1%) of private surface land in the north half of the tract. This portion of the tract is classified as Agriculture by SWReGAP (Lowry et al. 2007), but it is a mixture of agricultural grasses and native grasses, forbs, and shrubs. Plant species identified in the annual and perennial grasses community are crested wheatgrass, black sagebrush, California brome (*Bromus carinatus*), smooth brome, thistle (*Cirsium* spp.), rubber rabbitbrush, orchardgrass (*Dactylis glomerata*), intermediate wheatgrass (*Thinopyrum intermedium*), slender wheatgrass, Russian wheatgrass (*Thinopyrum junceiforme*), curlycup gumweed (*Grindelia squarrosa*), broom snakeweed, and Indian ricegrass (*Achnatherum hymenoides*). Wheatgrasses (*Elymus* spp.) and crested wheatgrass were the dominant plants encountered during reconnaissance surveys.

3.15.2.4 MEADOW

The meadow vegetation community accounts for 62.8 acres (1.8%) of land near the north end of the tract. This portion of the tract is also classified as Agriculture by SWReGAP (Lowry et al. 2007), because the land was historically or is currently used for agricultural purposes. Vegetation in the meadow community consists of hydrophytic (water-loving) plants such as wiregrass (*Juncus arcticus*), small-wing sedge (*Carex microptera*), Missouri iris (*Iris missouriensis*), foxtail barley (*Hordeum jubatum*), and seaside arrowgrass (*Triglochin maritima*). Canada thistle (*Cirsium arvense*), a Utah state-listed noxious weed, is also in this vegetation community.

Runoff from irrigated agricultural fields in the northwest part of the tract has produced wet meadow conditions in large portions of the meadow vegetation community. A preliminary JD was issued in November 2012, identifying the potential limits of existing wetlands, streams, and other water bodies in the tract that may be subject to the USACE's regulatory jurisdiction under the CWA. The preliminary JD identified approximately 54 acres of wetlands (USACE 2012a). These wetlands were classified into three habitat types. Approximately 31.6 acres were classified as irrigated wet meadow wetlands; 18.5 acres were classified as riparian wet meadow wetlands; and the remaining 3.8 acres were classified as mixed riparian scrub-shrub/wet meadow wetlands (Frontier Corporation USA 2012).

3.15.2.5 RABBITBRUSH

The rabbitbrush vegetation community occurs on 10.7 acres (0.3%) of the tract. This community is similar in structure and vegetative composition to the sagebrush/grassland vegetation community but also includes four-wing saltbush (*Atriplex canescens*) and a greater concentration of rubber rabbitbrush. This community occurs adjacent to riparian communities in the tract, and is classified as Rocky Mountain Lower Montane Riparian Woodland and Shrubland by SWReGAP (Lowry et al. 2007).

3.15.2.6 RIPARIAN

This vegetation community accounts for 55.3 acres of land along streams in the tract, and is classified as Rocky Mountain Lower Montane Riparian Woodland and Shrubland by SWReGAP (Lowry et al. 2007). The riparian community represents 1.5% of the total land in the tract. It includes approximately 18.5 acres of riparian wet meadow wetlands and 3.8 acres of mixed riparian scrub-shrub/wet meadow wetlands (Frontier Corporation USA 2012). Species such as willows (*Salix* spp.), cottonwoods (*Populus* spp.), Russian olive (*Elaeagnus angustifolia*), and tamarisk (*Tamarix* spp.) occur in the overstory of the tract's riparian communities. Understory species include wiregrass and saltgrass (*Distichlis spicata*) and weedy species such as curlycup gumweed and broom snakeweed (SWCA 2007a). A portion of the understory is disturbed (SWCA 2007a).

3.15.2.7 SAGEBRUSH/GRASSLAND

The sagebrush/grassland vegetation community accounts for 860.2 acres (24.1%) of land in the tract. This vegetation community includes areas classified by SWReGAP as Colorado Plateau Mixed Low Sagebrush Shrubland, Inter-Mountain Basins Big Sagebrush Shrubland, and Inter-Mountain Basins Montane Sagebrush Steppe (Lowry et al. 2007). Black sagebrush is the dominant shrub species in this community, with some big sagebrush and rabbitbrush plants also in the shrub layer. A few small Utah junipers and pinyon pines are occasional components of this community. Understory species include crested wheatgrass, California brome, cheatgrass, foxtail barley, thistle, slender wheatgrass, western wheatgrass (*Pascopyrum smithii*), Sandberg bluegrass (*Poa secunda*), broom snakeweed, Palmer's penstemon (*Penstemon palmeri*), and tall tumblemustard (*Sisymbrium altissimum*).

3.15.2.8 SAGEBRUSH/GRASSLAND (TREATED)

This vegetation community accounts for 749.1 acres (20.9%) in the tract. Dominant species are similar to those identified in the sagebrush/grassland vegetation community and include black sagebrush, big sagebrush, and rubber rabbitbrush in the shrub stratum. SWReGAP identifies this community as Recently Chained Pinyon-Juniper Areas (Lowry et al. 2007). Utah juniper, pinyon pine, and Gambel oak are also present in this community, although these species are not dominant. Understory species in this community are broom snakeweed, Russian wildrye (*Psathyrostachys juncea*), slender wheatgrass, thistles, cheatgrass, California brome, Palmer's penstemon, crested wheatgrass, and yarrow (*Achillea millefolium*).

The ground in this community is covered partially with chipped remnants of Utah juniper and pinyon pine trees. Because the quality of sagebrush habitats has been reduced due to pinyon-juniper encroachment and loss of understory forbs and grasses, the BLM removed these trees during prescription fuels treatments in fall 2005, chipped them on-site, and broadcasted them over the immediate area (Frey et al. 2008; Gubler 2008). Ninety-nine percent of pinyon-juniper trees on 1,700 acres in the Alton–Sink Valley area were removed, and the treated area was seeded with forbs and grasses to restore sagebrush steppe habitat (Frey et al. 2008).

3.15.3 At-Risk Habitat Types

The UDWR has identified at-risk habitat types and identified priority wildlife habitats based on factors such as abundance, degree of threat, and trends in abundance. The UDWR at-risk habitat types include several habitat types present in the tract: montane riparian (riparian), montane shrub (mountain shrub), and sagebrush steppe (the sagebrush steppe component of sagebrush/grassland). According to the UDWR, montane riparian habitat is very rare in the state (0.2% of total land cover), with approximately 60%–79% of remaining habitat currently impacted, and a definite decreasing trend (UDWR 2005). There may be portions of riparian habitat of high value in the tract, but the presence of invasive riparian species such as tamarisk and Russian olive suggests that this cover type is not pristine. Montane shrub habitat is also rare (1.3% of total land cover), with approximately 40%–59% of remaining habitat currently impacted, and a possible decreasing trend. Montane shrub (mountain brush) cover in the tract consists of small parcels dominated by Gambel oak. Although sagebrush steppe habitat is common (13.4% of total land cover), approximately 60%–79% of remaining habitat is currently impacted, and there is a definite decreasing trend. Several wet meadow and grassland cover types are also identified by UDWR (2005)as rare, priority habitat types, but these habitat types are not present in the tract. The meadow and annual and perennial grass cover types in the tract are both agricultural cover types that are not the rare habitats identified by UDWR (2005), even though they have value for local wildlife.

3.15.4 Invasive and Noxious Weeds

All non-native plant species identified during 2007 field reconnaissance surveys are listed in Table 3.15.2. This list includes invasive, noxious, and introduced weed species. Most of these species occur in disturbed sites such as private annual and perennial grasses communities and where vegetation treatments have occurred.

Table 3.15.2. Introduced, Invasive, and Noxious Weed Species Identified in the Alton Coal Tract

Common Name	Scientific Name	Status*	Location
Canada thistle	*Cirsium arvense*	Noxious	Meadow
Cheatgrass	*Bromus tectorum*	Invasive	Sagebrush
Russian olive	*Elaeagnus angustifolia*	Invasive	Riparian
Common mullein	*Verbascum thapsus*	Invasive	Sagebrush/grassland (treated)
Crested wheatgrass	*Agropyron cristatum*	Introduced	Sagebrush and annual and perennial grasses
Intermediate wheatgrass	*Thinopyrum intermedium*	Introduced	Annual and perennial grasses
Kentucky bluegrass	*Poa pratensis*	Native and introduced infra-taxa	Sagebrush and mountain brush
Orchardgrass	*Dactylis glomerata*	Introduced	Annual and perennial grasses
Small burnet	*Sanguisorba minor*	Introduced	Sagebrush/grassland (treated)
Tall tumblemustard	*Sisymbrium altissimum*	Invasive	Sagebrush/grassland (treated)
Tamarisk	*Tamarix* spp.	Noxious	Riparian

* Data from USDA (2008); Whitson (1996).

Introduced species are those that are not native to the lower 48 states. Many of the introduced species on this list, such as crested wheatgrass and intermediate wheatgrass, are forage plants brought intentionally to the United States for use as livestock feed. The USDA plants database (USDA 2008) was used to determine introduced statuses.

Invasive weeds are mostly introduced plant species that are able to spread faster than neighboring native species by being better equipped to take advantage of available water, sunlight, and nutrients. There are no federal or state lists of invasive weeds; the text *Weeds of the West* (Whitson 1996) was used to determine invasiveness statuses. Cheatgrass, tall tumblemustard, and common mullein are invasive weeds that occur in various communities in the tract.

Noxious weeds are plant species that have been formally recognized by federal, state, or county governments to pose serious risks to the economy of an area. The State of Utah has 19 listed noxious weed species. One of the Utah noxious weed species, Canada thistle, has been identified in the tract. A few individuals of this species are in the meadow vegetation community in the northwest section of the tract.

3.15.5 Special Status Species

Five federally listed plant species and 16 BLM-listed sensitive plant species are known to occur in Kane County, Utah (see Tables 1 and 2 in Appendix I's plant clearance report). Of these species, only a few are known to occur at the elevational range in the tract, and potential habitats are limited. Surveys for suitable habitat for special status plant species were conducted in November 2007, August 2008, and September 2008, and no potential habitats or occurrences of special status plant species have been identified in the tract. Because species conservation status and knowledge of distributions have been revised since the 2008 clearance surveys, an additional special status plant clearance analysis was conducted in 2012 (see Appendix I). Only Cronquist's phacelia (*Phacelia cronquistiana*; BLM sensitive) was identified as having potential to occur in the tract. Surveys of potential habitats for this species were conducted in June 2012, and no individuals were found (see Appendix I). Because there are no special status plant species in the tract, they are not discussed in Chapter 4.

3.16 Water Resources

The analysis area for water resources is the Kanab Creek watershed/shallow aquifer boundary. The Alton Coal Tract is in the upper reaches of the Kanab Creek watershed, a subdrainage to the Colorado River. The Kanab Creek watershed drains approximately 1,512,091 acres that include the tract as well as the towns of Alton and Kanab, Utah, and Fredonia, Arizona (Map 3.16). The watershed covers an elevation range from approximately 2,100 feet at the confluence with the Colorado River to 9,345 feet at the headwaters of Kanab Creek, which originates upstream of the tract on the Paunsaugunt Plateau. The tract is in an arid region where the average annual precipitation is approximately 12 inches in the lower elevations. Precipitation in the Kanab Creek watershed increases with elevation and can exceed 40 inches per year in the upper elevations. Most precipitation occurs as snow.

Groundwater systems in and adjacent to the tract are present in alluvial sediments, the Tropic Shale, and the Dakota Formation. Other water-related features that occur in the tract are riparian areas, probable wetlands, floodplains, and potential AVFs.

The reasonably foreseeable transportation route and coal loadout occur primarily in the Upper Virgin watershed (adjacent to the East Fork of the Virgin River), the Upper Sevier watershed (Sevier River, intersecting drainages, and along Bear Creek), and the Escalante Desert watershed in Iron County. West and south of the tract, the Virgin River watershed drains into the Colorado River. North of the tract, the Sevier River watershed drains north/northwest into Sevier Lake within the Great Basin.

3.16.1 Surface-water Resources

Around the tract, most of the annual runoff volume in streams draining the mountainous areas occurs during spring and early summer as a result of snowmelt and precipitation. The highest peak discharge commonly occurs during summer monsoonal storm events, which produce short bursts of intense precipitation. The total mean annual runoff from the Upper Kanab Creek basin into Arizona is approximately 50,000 acre-feet (Cordova 1981). Stream flows generally peak during March, but may vary from year to year depending on local weather conditions and yearly snowpack. Summer and early fall baseflow is typically much lower than spring conditions, except when infrequent storm-produced flows occur. Flows in the lower elevation streams are generally more variable than are flows originating in the mountainous region. The flows are influenced by spring lowland snowmelt, as well as rainstorms during the remainder of the summer and fall. In areas where stream waters are used for irrigation, water diversion from the streams for irrigation also substantially influences stream discharge rates.

Kanab Creek and two of its tributaries—Lower Robinson Creek and Simpson Hollow Creek—are the dominant surface-water features in the tract (Map 3.17). Kanab Creek flows in a south/southwesterly direction through the tract and downstream into Arizona. Within the Kanab Creek watershed, the tract is in the lower portions of the following three subwatersheds: Lower Robinson Creek, Kanab Creek below Reservoir Canyon, and Sink Valley Wash. These three subwatersheds have a combined area of 47,040 acres. The tract makes up 8% of these three subwatersheds and 0.25% of the entire Kanab Creek watershed. Also present is a network of ephemeral washes through which runoff from torrential precipitation events and seasonal snowmelt is drained from the land area in the tract. All the ephemeral washes in the tract and adjacent area are tributary to Kanab Creek. Although most of the ephemeral washes terminate directly into Kanab Creek, the ephemeral washes in the south portion of Block S drain into Sink Valley Wash, which flows into Kanab Creek approximately 5.5 miles south of the tract (see Map 3.17).

The quality of surface waters in and around the tract is variable. The State of Utah has designated the following three beneficial uses to the surface waters found in the tract (Kanab Creek downstream from the confluence with Reservoir Canyon and Lower Robinson Creek): 1) secondary contact recreation (2B), 2) nongame fish and associated food chains (3C), and 3) agricultural water supply (4). Secondary contact recreation (2B) refers to uses where full immersion does not occur, such as boating and wading. Waters designated for secondary contact recreation are required to maintain low bacteria counts to maintain healthy conditions for recreational users. Waters designated for nongame fish and associated food chains (3C) are required to exhibit appropriate levels of dissolved oxygen, temperature, pH, and other parameters needed to support aquatic life. Waters designated as agricultural water supply (4) (including irrigation and livestock watering) are required to be suitable for the irrigation of crops or as water for livestock. As such, they are required to meet general surface-water quality criteria for total dissolved solids (TDS), a common measure of salinity, and for various metals such as lead and cadmium.

Water-quality criteria are specific to designated beneficial uses; they include both numeric limits for individual pollutants or conditions and narrative descriptions of desired conditions. Section 303(d) of the CWA requires each state to submit a list to the EPA every two years identifying waters that fail state water-quality standards. The waters identified on the 303(d) list are known as impaired waters. Kanab Creek and its tributaries from the state line to the irrigation diversion at the confluence with Reservoir Canyon have recently been included on the 303(d) list of impaired waters based on exceedances of the 1,200 milligrams per liter (mg/L) TDS standard for irrigation water use. Previously, the lower portion of Kanab Creek (17.6 miles), from the Utah-Arizona state line north to Four-mile Hollow (13 miles north of Kanab) had been included on the 2008 list of impaired waters for exceedances of the TDS standard (1,200 mg/L for irrigation water use). Table 3.16.1 presents the applicable state water-quality standards for each constituent.

Table 3.16.1. Summary of State of Utah Water Quality Standards

	State Standard	Associated Beneficial Use
Temperature (degrees Celsius)	27	3C
pH	6.5–9.0	2B, 3C, 4
Dissolved oxygen (mg/L)	3.0*	3C
Total suspended solids (mg/L)	None	–
Nitrate and nitrite as N (mg/L)	4.0	2B
Total phosphorus (mg/L)	0.05†	2B
TDS (mg/L)	1,200.0	4

* One-day minimum standard.
† Threshold value.

During the initial mine startup construction for the Coal Hollow Mine in December 2010, discharges of both surface runoff from the mine area and groundwater intercepted in the mine pit areas to Kanab Creek occurred in response to unusually intense precipitation events. At that time, the region experienced the 10-year, 24-hour precipitation event, followed immediately by the 100-year, 24-hour precipitation event the following day (ACD, permit files at DOGM, 2013) (DOGM 2013a). In response to these anomalous precipitation events, discharges of surface-water runoff occurred. In response to continued wetness in early 2011, water was discharged from the mine's sedimentation ponds through the permitted UPDES discharge points. In the six UPDES discharge events that were monitored in 2011, the TDS concentrations of the mine discharge water ranged from 704 to 1,820 mg/L, averaging 1,037 mg/L. The discharge rates at the UPDES discharge points during these events ranged from 1.3 gallons per minute (gpm) to 15 gpm, averaging 5.4 gpm. The discharges that occurred in 2011 were both surface waters and groundwaters intercepted in the mine pit areas. Under more normal climatic conditions, discharges from the Coal Hollow Mine have been infrequent. The Coal Hollow Mine was designed to contain mine waters (and to use the water for mine operational uses such as dust suppression) such that discharge to the receiving waters would not usually be necessary. There have been no UPDES discharges from the mine operation since November 2011.

3.16.1.1 KANAB CREEK

3.16.1.1.1 Surface-water Quantity and Use

Through most of the tract, the main stem of Kanab Creek is categorized in the National Hydrography Dataset as a perennial stream that has flow throughout the year. However, observed flow in Kanab Creek is highly dependent on climate and upstream water use and has been observed to run very low (less than 0.1 cubic feet per second [cfs]) through the tract during the summer (Petersen Hydrologic 2007). Monitoring of surface-water discharge rates and water quality parameters has occurred at monitoring sites SW-1A, SW-1, Kanab at C.R., SW-3, SW-2, and Kanab-L (Petersen Hydrologic 2013).

Discharge in the upper reaches of Kanab Creek, including tributaries that flow through the tract, is generally seasonal. Most of the water in Kanab Creek upstream of the town of Alton is diverted for irrigation during much of the year, leaving low flows in Kanab Creek downstream of the town and through the tract (see Appendix F). Discharge rates in Kanab Creek in and adjacent to the tract are substantially influenced by irrigation diversions of surface water from the creek. Kanab Creek irrigation diversions are present in and north of the tract. It is common for Kanab Creek to have little or no discharge south of the tract during much of the year. No irrigation diversions on Kanab Creek have been identified for a distance of at least 23 miles downstream from the lowermost irrigation diversion in the tract, which is just above the confluence of Lower Robinson Creek (Utah Division of Water Rights 2014).

The closest USGS gaging station to the tract is downstream north of Kanab (Station No. 09403600; see Map 3.17). The closest National Climatic Data Center (NCDC) weather station to the tract is south of the town of Alton (NCDC Alton Station No. 420086; see Map 3.17). Figure 3.16.1 shows Kanab Creek discharge from the USGS gaging station and precipitation recorded at the NCDC Alton Station from July 2000 to July 2010. Although the precipitation and stream discharge measurements were not taken in the tract, they are approximately representative of the relationship between rainfall and stream flow in the tract.

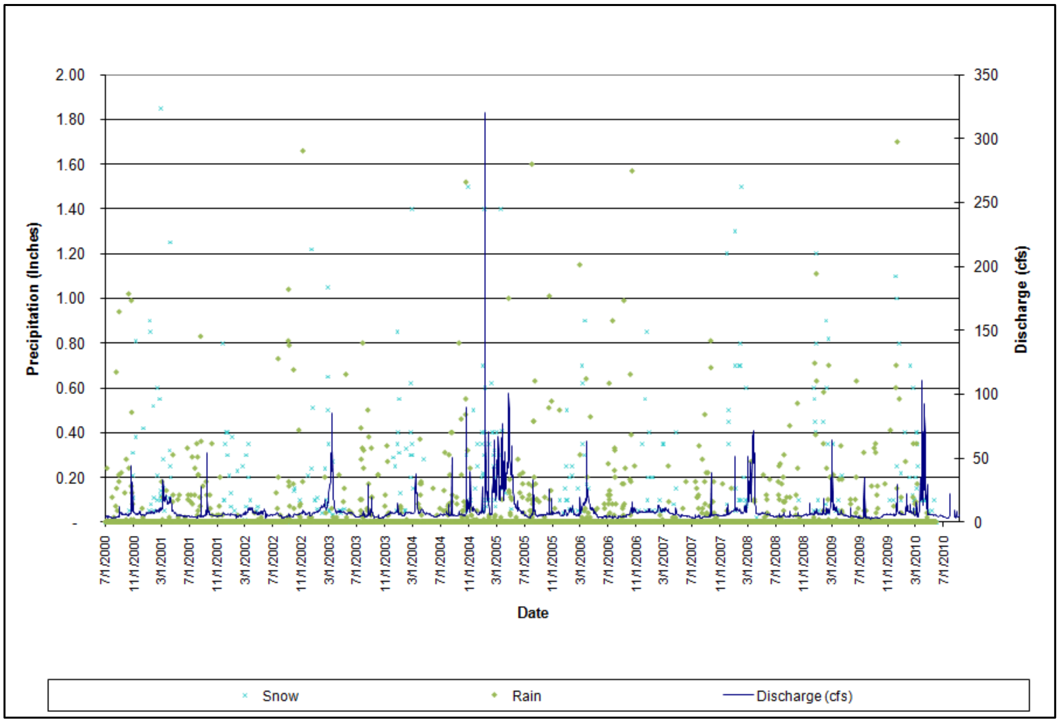

Figure 3.16.1. Precipitation at NCDC Alton Station No. 420086 and Kanab Creek discharge at USGS Station No. 09403600 from July 2000 to July 2010.

Flow data have been collected by Petersen Hydrologic on a quarterly basis since 2005 at three monitoring sites on Kanab Creek. These monitoring sites are, from upstream to downstream, SW-1, SW-3, and SW-2. Flows have also been collected at a fourth monitoring site (SW-5) on Lower Robinson Creek before it enters Kanab Creek (see Map 3.17). Figure 3.16.2 shows the flows measured at each site along Kanab Creek between 2005 and 2009; flows entering Kanab Creek from Lower Robinson Creek ranged from 0 to 0.9 cfs during this period.

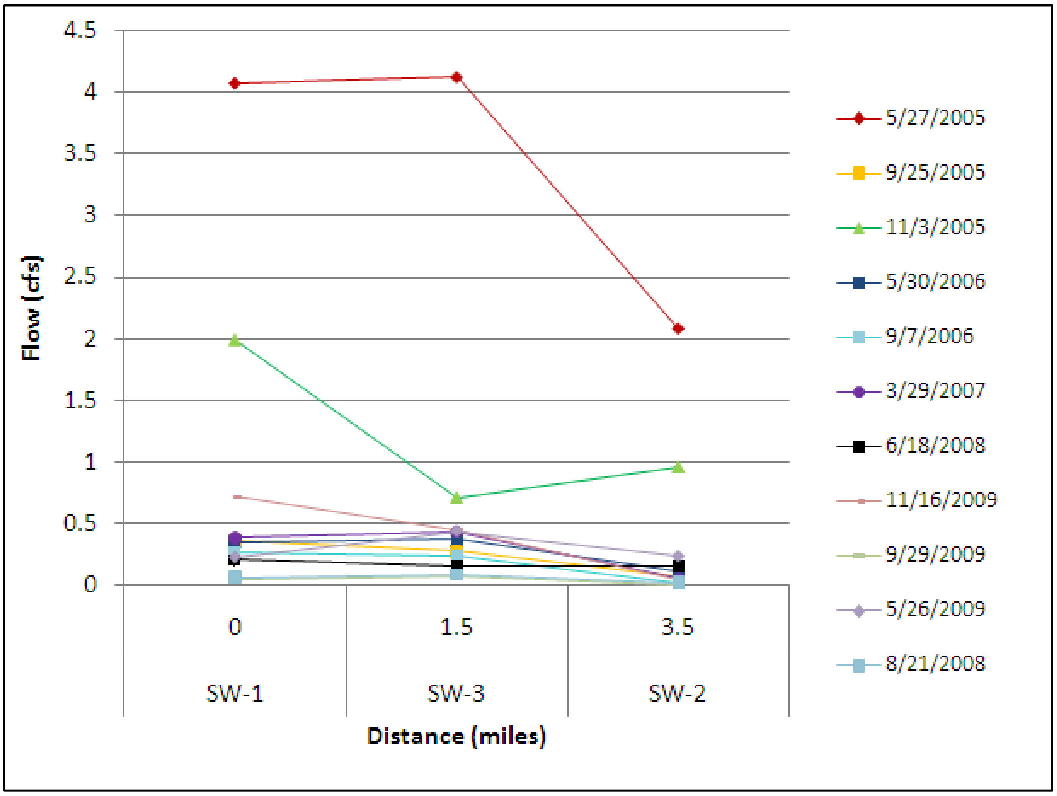

Figure 3.16.2. Discharge (flow) at Kanab Creek surface-water monitoring sites in the Alton Coal Tract, 2005–2009 (DOGM 2014). Distance starts at the first upstream monitoring site (SW-1) (Petersen Hydrologic 2007). See Map 3.17 for location of monitoring sites.

Beginning in 2011 and 2012, Petersen Hydrologic (2013) started collecting flow data from several additional monitoring sites on Kanab Creek and its tributaries. Sites where flow data were collected include (in upstream to downstream sequence) SW-1A, SW-1, Kanab at C.R., SW-3, Kanab-Mid, SW-2, and Kanab-L (see Map 3.17). In Figure 3.16.3, the flows measured in Kanab Creek during high-flow conditions (March 2013) are plotted. Flows measured during baseflow conditions (September 2012) are plotted in Figure 3.16.4. A discharge hydrograph for Kanab Creek as monitored at SW-3 is presented in Figure 3.16.5.

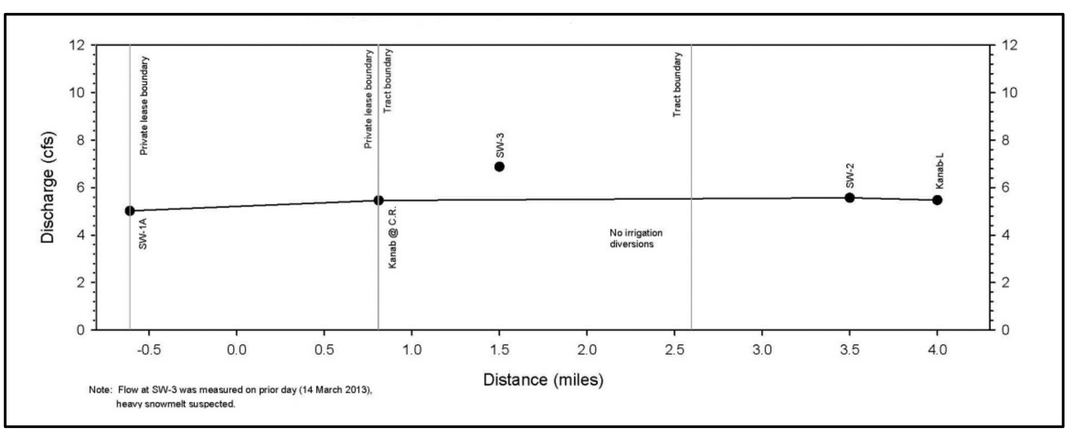

Figure 3.16.3. March 2013 Kanab Creek measurements (high-flow conditions).

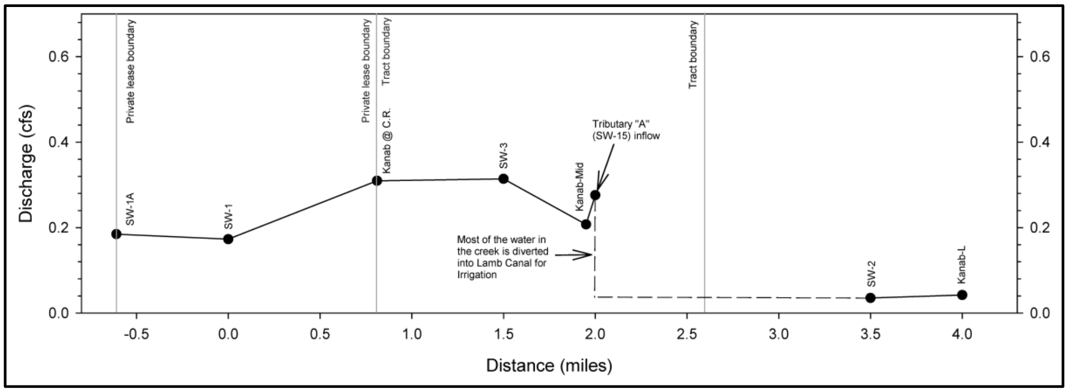

Figure 3.16.4. September 2012 Kanab Creek measurements (low-flow conditions).

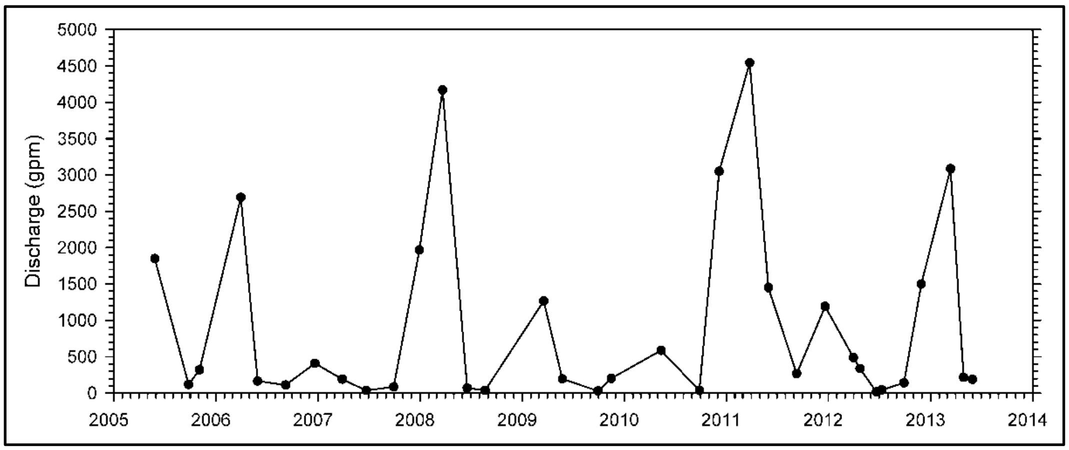

Figure 3.16.5. Kanab Creek discharge hydrograph.

When the creek was measured during high-flow conditions in March 2013, the stream gained by approximately 9%, or 0.44 cfs, between SW-1A (discharging at 5.02 cfs) and Kanab at C.R. (discharging at 5.46 cfs) (see Figure 3.16.3). Hydrological studies indicate that the modest gain between these two sites may be attributable to discharge into the stream channel from saturated alluvial sediments beneath the irrigated farming areas that are present between these two sites. Discharges measured at the lower three sites (Kanab at C.R., SW-2, and Kanab-L) are very similar (within the flow measurement accuracy) at approximately 5.5 cfs. The absence of appreciable variability in the discharge rates measured during high-flow conditions at the lower three monitoring sites suggests that there is no appreciable interaction between surface waters and groundwaters during the high-flow conditions (i.e., the stream neither loses water to the groundwater system nor gains water from groundwater discharge to the stream). This information also indicates that, during high-flow periods, Kanab Creek derives most of its flow from upgradient areas (north and east of the tract).

When Kanab Creek stream flows were measured during low-flow conditions in late September 2012, the flow measured at the upstream location SW-1A (82.8 gpm) was similar to that measured at SW-1 (77.6 gpm). However, the flow measured at Kanab at C.R. (139 gpm) was greater than that measured at SW-1 by approximately 61 gpm, representing a 79% increase in the flow. This increase in flow may also be attributable to discharge from saturated alluvial sediments beneath the farming areas that are present between these two sites. The flow measured at SW-3 (141 gpm) was essentially the same as that measured at Kanab at C.R. However, the discharge measured at Kanab-Mid (93 gpm) represents a loss of 48 gpm. Discharge from Simpson Hollow Creek to Kanab Creek was measured at 30.5 gpm. The discharges measured at the two downstream monitoring sites (SW-2 and Kanab-L) were substantially lower, at approximately 16 gpm and 19 gpm, respectively. The decreases in flow between SW-3 and SW-2 are due to a combination of factors, including 1) irrigation diversions approximately 0.5 mile downstream from SW-3, 2) lack of local or regional recharge to the shallow aquifer sufficient to sustain baseflow (a losing stream), and 3) loss of water to evapotranspiration. It is common for Kanab Creek to have little or no discharge south of the tract during much of the year. Therefore, flows in Kanab Creek at the tract's south boundary are minimal or nonexistent for most of the year.

The primary uses of surface water in Kanab Creek are irrigation and stock watering. Irrigation around the town of Alton makes up the greatest portion of use (see Appendix F). Irrigation in the area is predominantly conducted with sprinklers, although some flood irrigation is also used. Flood-irrigated lands are found in the Kanab Creek valley near the confluence with Lower Robinson Creek and just south of the town of Alton (see Appendix F). During times when irrigation water is not being diverted at upstream locations (typically during the winter and early spring months), more substantial surface-water flows are present in the drainage (Petersen Hydrologic 2013).

3.16.1.1.2 Surface-water Quality

Water quality has been monitored in Kanab Creek at locations upstream, within, and downstream of the tract (see Map 3.17). The quality of the water in the creek varies appreciably by season and also by location within the area. The TDS concentrations measured in Kanab Creek in and near the tract (2005–2013) have ranged from 384 to 2,058 mg/L (Petersen Hydrologic 2013). The TDS concentrations in Kanab Creek measured approximately 6 miles south of the tract at USGS Station No. 04951830 (1999–2008) have ranged from 372 to 2,262 mg/L. There are several tributaries to Kanab Creek in and adjacent to the tract that discharge water that usually exceeds 2,000 mg/L TDS (Petersen Hydrologic 2013).

The lowest TDS concentrations measured in Kanab Creek near the tract have usually occurred during periods of high flow (Figure 3.16.6). During periods of low flow, higher TDS concentrations are commonly observed (Petersen Hydrologic 2013). The TDS concentrations of most groundwaters in and adjacent to the tract as well as surface waters that are tributary to Kanab Creek in the area commonly have TDS concentrations that are appreciably higher than are waters in Kanab Creek (Petersen Hydrologic 2013). Consequently, when the amount of discharge in Kanab Creek is large relative to the magnitude of local groundwater or surface-water inflow to the creek, the TDS concentrations are lower than when the discharge rates in Kanab Creek are low.

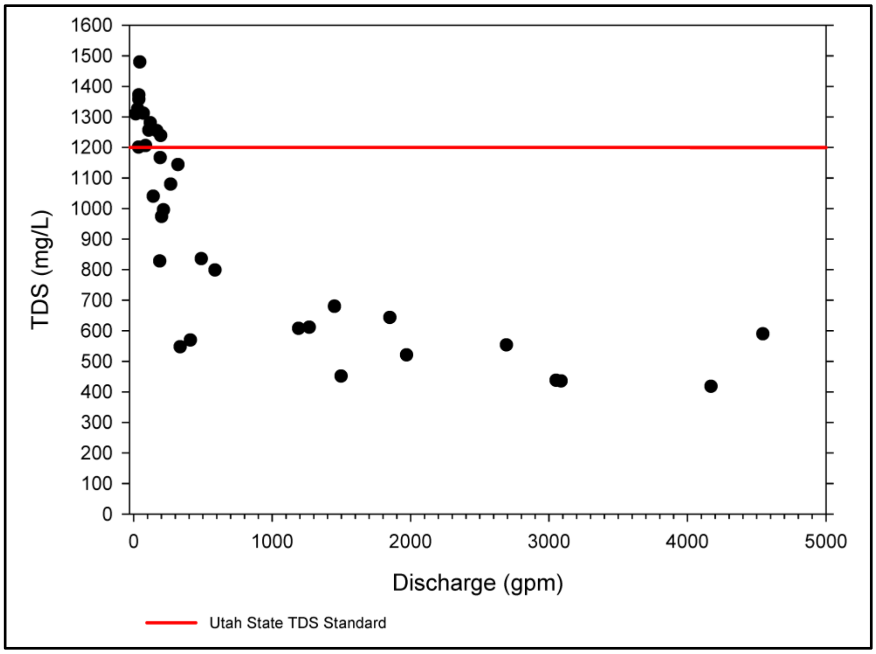

Figure 3.16.6. TDS concentrations at Kanab Creek.

Monitoring data indicate that the TDS of surface water in Kanab Creek increases as it flows through the tract during both high-flow and low-flow conditions (Petersen Hydrologic 2013). Plots of TDS concentrations in Kanab Creek water are presented in Figures 3.16.7 and 3.16.8. During high-flow conditions (March 2013), TDS concentrations increased by 156 mg/L (about 40%) from the upstream monitoring site SW-1A (384 mg/L) to the downstream monitoring site Kanab-L (540 mg/L). During low-flow conditions (September 2012), the TDS in the creek increased by 746 mg/L (about 76%) from SW-1A to Kanab-L. There had been no discharges of mine water from the Coal Hollow Mine in the year prior to these monitoring events.

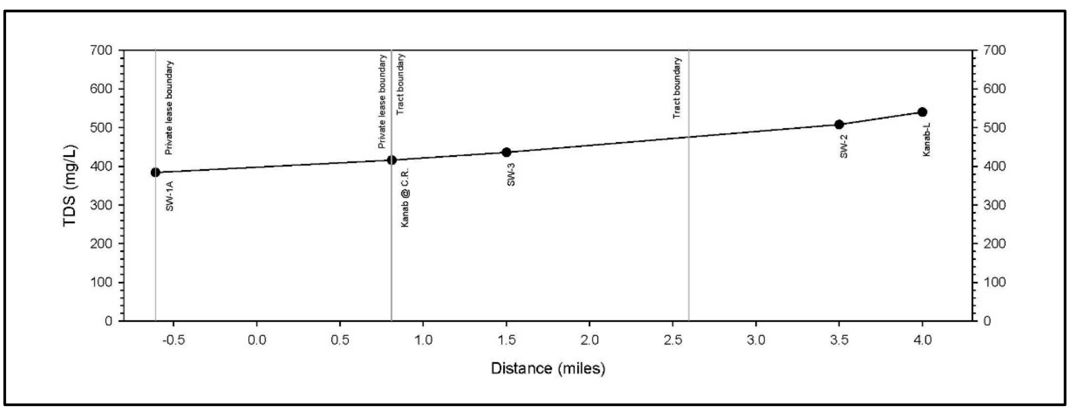

Figure 3.16.7. March 2013 Kanab Creek TDS measurements (high-flow conditions).

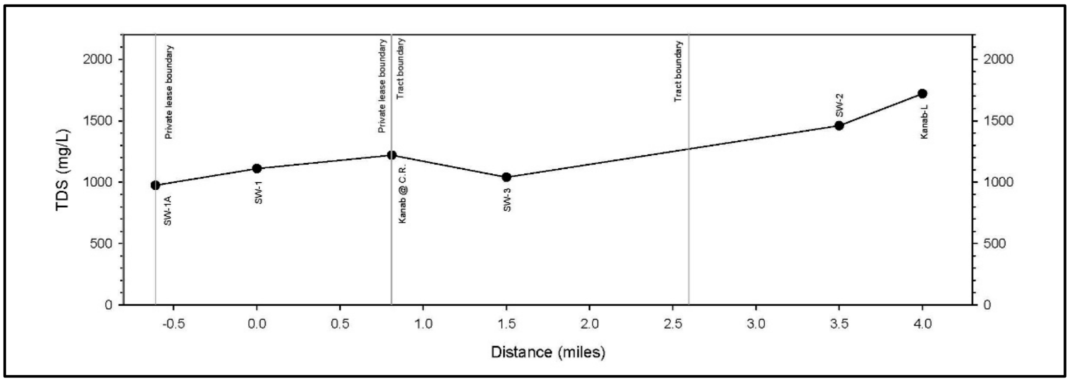

Figure 3.16.8. September 2012 Kanab Creek TDS measurements (low-flow conditions).

As Kanab Creek waters flow over the tract, the TDS concentrations in the creek increase, likely in response to 1) the inflow of locally derived groundwaters and surface waters with high TDS; 2) the dissolution of soluble evaporite minerals present in the rocks and sediments of the streambed and streambanks; and 3) evapoconcentration of creek waters, particularly during the warm summertime months when the evaporation potential is greatest. In areas where unstable bed and bank conditions result in appreciable erosion potential and associated transport of eroded sediment particles into the stream flow, the potential for increases in both TDS and suspended solids concentrations in the stream is exacerbated.

Temperatures measured in Kanab Creek (2005–2013) vary considerably with season. Temperatures near 0 degrees Celsius (°C) are common during the wintertime months, whereas temperatures as high as 26.9°C have been measured during the warm summertime months (Petersen Hydrologic 2013). The measured pH of water in Kanab Creek has ranged from 7.60 to 8.94. Dissolved oxygen levels measured in the creek have ranged from 6.1 to 12.1 mg/L, with the lower values typically occurring during the warm summertime months. Total suspended solids (TSS) concentrations have ranged from less than detectable levels to a maximum of 3,616 mg/L. The highest measured TSS concentrations generally correlate with periods of high discharge rates in the creek (Petersen Hydrologic 2013). Concentrations of nitrate and nitrite (as N) are usually low in the creek, with a maximum measured concentration of 2.17 mg/L. Concentrations of total phosphorous in Kanab Creek are also usually low (near the lower laboratory detection limit), although periodically total phosphorous concentrations exceeding 0.05 mg/L (ranging up to 0.18 mg/L) have been measured in Kanab Creek. The State of Utah has established a threshold indicator value of 0.05 mg/L total phosphorus concentration in streams and rivers as a trigger for further, in-depth assessment of water body condition and needs. This indicator value applies to recreation use in the watershed. Total phosphorus exceedances of the designated beneficial use threshold (0.05 mg/L) occur routinely in surface waters in and around the tract.

3.16.1.2 SIMPSON HOLLOW CREEK

3.16.1.2.1 Surface-water Quantity and Use

Simpson Hollow Creek is an intermittent tributary to Kanab Creek that flows from source areas near and below the town of Alton into Kanab Creek. Portions of the water source area for Simpson Hollow Creek are in Block NW. Monitoring for flow is also performed at sites Creek 1 and Creek 2, which are in the East Fork of Simpson Hollow Creek in upstream areas (Petersen Hydrologic 2013; see Map 3.17).The flows in Simpson Hollow Creek have been monitored at SW-15, which is at the confluence of the tributary with Kanab Creek (Petersen Hydrologic 2013; see Map 3.17). Discharge from Simpson Hollow Creek monitored during 2012 at SW-15 ranged from no flow in May 2012 to 481 gpm (1.07 cfs) in

February 2012 (Figure 3.16.9). Similarly, during 2013, discharge measured in the drainage ranged from no flow in May 2013 to 299 gpm (0.67 cfs) in April 2013. Throughout nine monitoring events in 2012 and 2013, the average discharge rate measured in the tributary was 108 gpm (0.241 cfs).

A water-storage reservoir with a surface area of approximately 4 acres is present in the west fork of Simpson Hollow Creek drainage (Frontier Corporation 2012; Map 3.18). Controlled releases of water from the reservoir can occur in response to agricultural needs. The timing of these releases likely influences the magnitudes of flows monitored at SW-15. The principal sources of water to Simpson Hollow Creek include 1) runoff of snowmelt and precipitation waters from the land surface within the tributary, 2) irrigation return flows (including surface runoff and shallow subsurface interflow runoff) from several large irrigated fields in the drainage area, and 3) groundwater discharge from a series of springs.

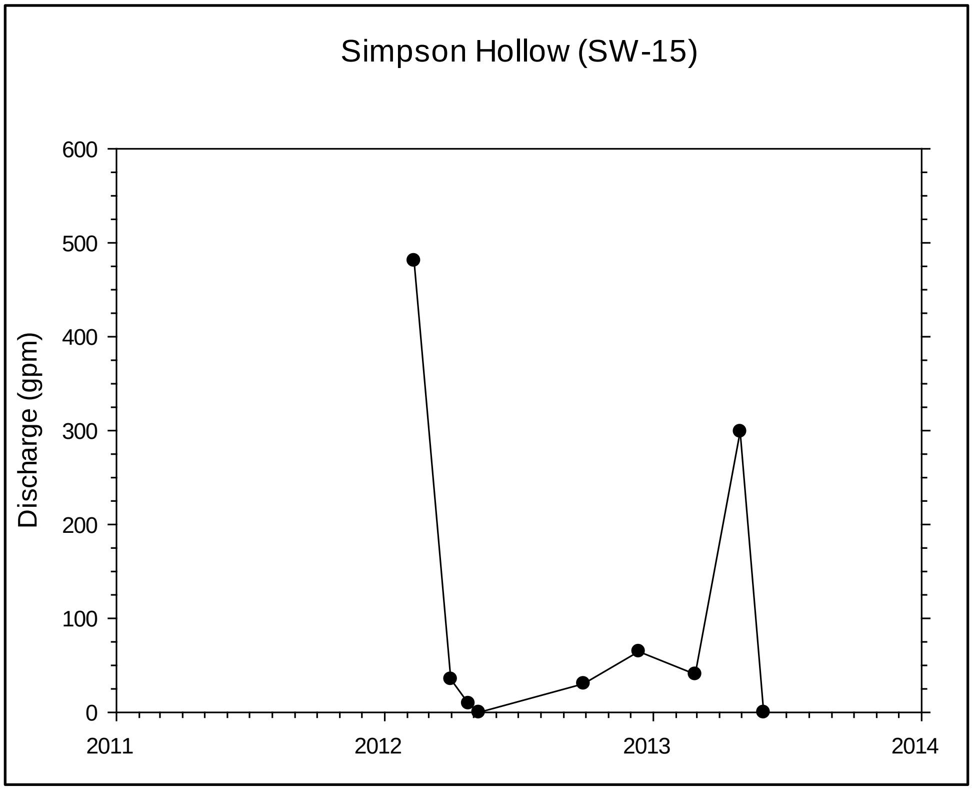

Figure 3.16.9. Simpson Hollow Creek discharge.

The uses of surface water in Simpson Hollow Creek include stock watering directly on the stream. Flow from Simpson Hollow Creek into Kanab Creek may also contribute to the quantity of surface water available for irrigation use in downstream locations.

3.16.1.2.2 Surface-water Quality

TDS concentrations measured in Simpson Hollow Creek at SW-15 in 2012 and 2013 ranged from 1,620 to 3,880 mg/L, averaging 3,033 mg/L (Petersen Hydrologic 2013). The surface waters are generally of the magnesium sulfate geochemical type. Surface waters in the east fork of Simpson Hollow Creek are also of the magnesium sulfate geochemical type. TDS concentrations measured in this tributary at monitoring site Creek 1 ranged from 656 to 4,250 mg/L. TDS concentrations measured higher in this same tributary at Creek 2 in the northeast portion of Block NW ranged from 10,000 to 10,700 mg/L. Discharge rates measured at Creek 2, which is a headwater area for Simpson Hollow Creek that is sourced largely from nearby diffuse groundwater seepage areas, were less than 1 gpm (0.002 cfs) during each of the three monitoring events at that location (Petersen Hydrologic 2013).

Temperatures measured at the mouth of Simpson Hollow Creek (SW-15) ranged from 0.2°C to 17.3°C. The pH of the water varied from 8.34 to 8.67. Dissolved oxygen values ranged from 7.41 to 11.8 mg/L. TSS concentrations ranged from 4 to 14 mg/L. Nitrate and nitrite (as N) were below laboratory detection limits. Total phosphorous concentrations ranged from 0.02 to 0.07 mg/L. As indicated, the TDS concentrations measured at the three monitoring sites on Simpson Hollow Creek all exceed the 1,200-mg/L state standard for irrigation use.

3.16.1.3 LOWER ROBINSON CREEK

3.16.1.3.1 Surface-water Quantity and Use

Lower Robinson Creek is a tributary to Kanab Creek that originates from small canyons in the foothills of the Paunsaugunt Plateau east of the tract and flows east to west through the middle of the tract. Flows in Lower Robinson Creek are usually minimal. In its upper and middle reaches, Robinson Creek is an ephemeral wash with discharge occurring rarely (see monitoring site data for SW-4 and SW-101; Petersen Hydrologic 2013). In the lower reach of Lower Robinson Creek, small quantities of alluvial groundwater (typically approximately 5 gpm) seep into the deeply incised stream channel near monitoring site BLM-1 (Petersen Hydrologic 2013). Alluvial seepage water in Lower Robinson Creek (which is monitored at BLM-1 and SW-5) commonly persists in the stream channel to the confluence with Kanab Creek.

In its upper and middle reaches, Lower Robinson Creek is an ephemeral wash that rarely discharges. During the 29 monitoring events that have occurred at SW-4 since 2005, discharge has been only observed on one occasion. On that occasion in May 2005, a discharge of 539 gpm was measured. At that time, the region was experiencing a springtime snowmelt event during a very wet year. Appreciable discharge has infrequently been observed at SW-101 in the middle reach of Lower Robinson Creek (see Map 3.17). Discharge at SW-101 has only been observed during periods of appreciable snowmelt or during torrential precipitation events. The maximum discharge measured at SW-101 was 18.0 cfs (8,080 gpm), which occurred during a two-year, 24-hour event in October 2010.

In the lower reach of Lower Robinson Creek, small quantities of alluvial groundwater (typically approximately 7 gpm or less) seep into the deeply incised stream channel near monitoring site BLM-1 (Petersen Hydrologic 2013). Petersen Hydrologic (2007) reports that the discharge derives from the seepage of alluvial groundwater into the Lower Robinson Creek stream channel, which discharges where the stream channel intersects the relatively impermeable Dakota Formation. This alluvial seepage water in Lower Robinson Creek (which is monitored at BLM-1 and SW-5) commonly persists in the stream channel to the confluence with Kanab Creek. At other times, the water is lost to evapotranspiration or infiltrates completely into the gravelly Lower Robinson Creek channel substrate near the confluence with Kanab Creek.

In addition to the arid climate, the low-flow conditions of Lower Robinson Creek are also attributable to the fact that it is a losing stream in its lower reach, which loses flow to alluvial deposits under its channel and to evapotranspiration. In addition, the creek crosses a north-south-trending ridge of Tropic Shale along the Sink Valley Fault (see Map 3.10) that tends to divert water flowing through this alluvium along the fault and into shallow aquifers in Sink Valley rather than diverting it downstream.

There is only very limited use of stream waters in the middle and upper reaches because the watercourse is usually dry. In the lower reach of Lower Robinson Creek, the small alluvial seepage flows are used by wildlife and are also used for stock watering directly along the stream. There are no irrigation diversions in the lower reach of Lower Robinson Creek. Non-extractive coal mining–related activities associated with the Coal Hollow Mine are currently occurring on lands in the tract that have private surface ownership in the Lower Robinson Creek drainage. These activities, which are regulated under a mining permit administered by DOGM, include coal haulage, stockpiling, and loadout operations; soil stockpiling operations; equipment maintenance operations; surface-water treatment in on-site sediment ponds and activities associated with the mine office facilities and associated roadways and parking lots. Although infrequent, periodic discharges of mine water from the Coal Hollow Mine to Lower Robinson Creek occur.

3.16.1.3.2 Surface-water Quality

The water quality of surface waters monitored in the ephemeral upper and middle reaches of Lower Robinson Creek has been variable. The TDS concentrations measured in the drainage (at SW-101) have ranged from 309 to 3,751 mg/L. Generally, the lower TDS values are associated with the highest discharge rates in the creek. The higher TDS measurements have occurred during periods of moderate to low discharge in the stream (Petersen Hydrologic 2013). Temperatures measured in the ephemeral reaches of Lower Robinson Creek ranged from 0.9°C to 17.7 °C. The pH of the stream water ranged from 7.39 to 8.62. Dissolved oxygen concentrations ranged from 5.64 to 11.7 mg/L. TSS concentrations ranged from 6 to 171,968 mg/L, with the highest values measured during high-discharge events. Although there is no longer a state standard for TSS, the maximum values recorded in and around the tract are very high. The maximum recorded TSS value measured on or near the tract is 171,968 mg/L, which occurred on October 5, 2010, at SW-101. At that time, the discharge measured in the ephemeral creek was 8,080 gpm (18.0 cfs). Other high values were recorded at the same location, including a TSS of 22,752 mg/L on March 18, 2009; 13,404 mg/L on March 21, 2008; and 9,020 on March 30, 2010. Total phosphorous concentrations ranged from nondetectable to 2.94 mg/L. Nitrate and nitrite (as N) concentrations ranged from nondetectable to 1.32 mg/L. In the lower reaches of Lower Robinson Creek, small quantities of discharge (less than approximately 5 gpm) sourced from alluvial groundwater seepage are usually present. The measured TDS concentrations of the seepage waters in the drainage have ranged from 751 to 1,680 mg/L.

3.16.1.4 EPHEMERAL WASHES

3.16.1.4.1 Surface-water Quantity and Use

Surface runoff on much of the land surface in the tract is drained through a network of ephemeral washes that flow only in response to periods of snowmelt or torrential rainfall. Because surface water is usually not present in these drainages, the potential for use of the infrequent surface flows is minimal. Additionally, because many of the ephemeral washes in the tract are currently in an unstable condition, the streambanks and streambed often undergo significant erosion during appreciable stream discharge events. As a result, when appreciable flows are present in the ephemeral washes, the water often contains high suspended solids concentrations, which limit their potential for use (Petersen Hydrologic 2013). Within the tract, Frontier Corporation (2012) has delineated 16 ephemeral stream channels with a combined channel length of nearly 30,000 feet. During the Frontier Corporation field survey in 2012, no surface water was observed in any of these ephemeral channels.

Sink Valley Wash is among the most substantial of the ephemeral drainages near the tract. Monitoring data indicate that Sink Valley Wash (east and south of the tract) flows only during periods of appreciable snowmelt or in response to torrential rainfall events (Petersen Hydrologic 2007). There is no measurable groundwater-derived baseflow discharge component in Sink Valley Wash. Surface-water runoff from the land area in the south portion of Blocks S and Sa drains into Sink Valley Wash. In this area, groundwater discharge from springs and seeps (which could contribute to surface-water flows in Sink Valley Wash) is less than 1 gpm, and the quality of the quantities of water that does discharge from the springs is poor, with TDS concentrations ranging from 3,780 to 14,900 mg/L (see Section 3.16.2.4.1). For these reasons, surface waters originating from the tract that contribute to Sink Valley Wash flows are of limited use. It is noted that additional springs and seeps are in Sink Valley outside (east) of the tract. Groundwater discharges from these springs and seeps do not support baseflow discharge in the ephemeral Sink Valley Wash (Petersen Hydrologic 2007).

Surface-water flows exiting Sink Valley Wash near the tract's southeast edge in the southeast portion of Block S are also ephemeral, with flow occurring only during the spring snowmelt event or in response to large precipitation events (Table 3.16.2). During 40 discharge monitoring events on Sink Valley Wash at monitoring site SW-6 since 2005, the measured discharge has ranged from 0 to a maximum of 3.05 cfs (1,370 gpm), which occurred on March 22, 2008. During that time, appreciable discharge at SW-6 had been observed in response to the springtime snowmelt event in Sink Valley. At monitoring site SW-9, which is on Sink Valley Wash downstream from the tract, measured discharge has ranged from 0 to 1.1 cfs (492 gpm). It is noteworthy that when SW-9 was visited on March 22, 2008 (the date of the greatest measured discharge at SW-6), there was no discharge in Sink Valley Wash at SW-9.

Table 3.16.2. Flows Measured at SW-9 in Sink Valley Wash

Date	Flow (cfs)
01/13/1988	0.00
02/16/1988	1.70
03/24/1988	0.00
06/17/2005	0.00
09/24/2005	0.00
11/03/2005	0.00
03/30/2006	0.02
05/29/2006	0.00
06/18/2006	0.00
12/20/2006	0.00
03/29/2007	0.00
06/20/2007	0.00
09/30/2007	0.00
12/29/2007	0.00
03/21/2008	0.41
03/22/2008	0.00
6/17/2008	0.00
8/20/2008	0.00
12/30/2008	0.00
3/18/2009	0.00
5/24/2009	0.00
9/29/2009	0.00
11/18/2009	0.00
3/30/2010	0.02
4/23/2010	0.07
5/6/2010	0.00
5/13/2010	0.00
9/28/2010	0.01
12/7/2010	0.00

Table 3.16.2. Flows Measured at SW-9 in Sink Valley Wash

Date	Flow (cfs)
3/26/2011	0.00
5/31/2011	1.10
9/6/2011	0.00
12/19/2011	0.00
3/29/2012	0.00
5/8/2012	0.00
9/29/2012	0.00
12/13/2012	0.00
5/31/2012	0.00

Source: *Reconnaissance Alluvial Valley Floor Investigation in the Alton Coal Tract LBA and Adjacent Areas* (included as Appendix F), and Petersen Hydrologic 2013.

During monitoring of ephemeral stream channels performed by Petersen Hydrologic (2013) (at EW-1, EW-2, EW-2a, EW-3, and RG-L), the measured discharge rates have ranged from 0 to 24.5 gpm. As discussed in Section 3.16.1.3.2, discharges in the ephemeral reaches of Lower Robinson Creek in the tract of up to 18 cfs have been measured. Appreciable discharges have also been observed in other ephemeral washes in the tract (Petersen Hydrologic 2013).

3.16.1.4.2 Surface-Water Quality

The quality of waters present in ephemeral drainages in and around the tract is variable (Petersen Hydrologic 2013). TDS concentrations measured in the ephemeral drainages range from a minimum of 112 mg/L to a maximum of 4,980 mg/L (Table 3.16.3). The wide range of observed TDS concentrations is likely related to 1) the degree to which runoff waters physically interact with soluble minerals in the ephemeral drainage, and 2) the mineralogical composition of the sediments that come into contact with the runoff waters. Because many of the ephemeral washes are currently in an unstable condition, TSS concentrations in discharges in ephemeral washes, particularly during high-flow conditions, are often elevated (Petersen Hydrologic 2013).

Table 3.16.3. Water Quality Data from Ephemeral Washes (2005–2013)

Wash	Minimum TDS (mg/L)	Maximum TDS (mg/L)
Unnamed wash (EW-1)	112	2,740
Unnamed wash (EW-2)	986	4,840
Unnamed wash (EW-3)	246	432
Unnamed wash (RSD-1)	400	400
Unnamed wash (RG-L)	3,720	4,980
Sink Valley Wash (SW-6)	127	2,220
Sink Valley Wash (SW-9)	360	3,400
Lower Robinson Creek, ephemeral reach (SW-101)	309	3,751

3.16.1.5 DRAINAGE CONDITIONS

On private lands in the tract, the natural drainage channels associated with Kanab Creek and Lower Robinson Creek are susceptible to downcutting and mass wasting (Petersen Hydrologic 2007). Petersen Hydrologic (2007) reports that in some areas these channels have been downcut by several tens of feet below the surrounding topography. Petersen Hydrologic also reports that there is headcutting in the Sink Valley Wash and active erosion and collapse of the steep arroyo walls along Robinson Creek. Kanab Creek is a deeply incised arroyo channel with steep walls lining the creek bed where the stream has downcut into nearby sediment (Cordova 1981). As recently as 2005, landslides along the arroyo faces of Kanab Creek have been reported as a natural slope-failure slide (Lund 2005). The deteriorated condition of stream channels is largely attributed to historic land-management practices and the natural erosive properties of the soil and geology in this area (Petersen Hydrologic 2007). Various reaches of the stream channels in the tract and surrounding areas exhibit these conditions to varying degrees (e.g., in some stream reaches, more stable configurations are present).

Kanab Creek, Lower Robinson Creek, and Sink Valley Wash all experience downcutting during large precipitation events, creating near-vertical streambanks. These streambanks are unstable and result in mass wasting of sediment into the channel. The movement of large quantities of sediment during spring melt and large precipitation events modifies the stream channel on a regular basis. Along the creek margin, where lower slopes make it possible, cottonwood and willow trees along with sagebrush and grasses grow in a limited riparian area, stabilizing the streambank in these areas.

As defined by the BLM’s Proper Functioning Condition Assessment protocol (BLM 2008c) and based on a field assessment conducted in November 2010, the functional rating for public land portions of Upper Kanab Creek is “Proper Function Condition,” whereas the functional rating of public lands portions of Lower Robinson Creek is “Functional – At Risk” (BLM 2010b). The segments of Upper Kanab Creek and Lower Robinson Creek that were assessed by the BLM in 2010 are shown on Map 3.19. Proper function condition assessments have not been conducted for private lands in the tract.

3.16.2 Groundwater

The tract is at the base of a valley along the north-south axis of Kanab Creek. The complex geology and structure (faults and folds) of the Alton Coal Field forms a complex hydrogeologic setting vertically and laterally across and adjacent to the tract. In general, the vertical hydrogeologic units consist of unconsolidated clay, silt, sand, and gravel alluvial sediments that have been deposited near drainages and overlay the relatively impermeable Tropic Shale. The hydrogeology below the Tropic Shale consists predominantly of low-permeability shaley strata interbedded with lenticular (lens-like), fine- to medium-grained sandstones of the Dakota Formation. The Smirl Coal Zone, which is at the top of the Dakota Formation near the contact with the Tropic Shale, is reported to have a moisture content of approximately 13% (2004). However, most or all of this moisture is physically or chemically bound to the coal itself, and as such, it does not constitute a usable groundwater resource.

Groundwater systems in and adjacent to the tract are present in alluvial sediments, the Tropic Shale, and the Dakota Formation. Aquifer properties and groundwater resources beneath the Alton Coal Field have been investigated through extensive drilling, hydrogeologic characterization, and surface and groundwater monitoring (Doelling et al. 1972; Petersen Hydrologic 2007, 2013; UII 1987a). Detailed investigations of groundwater systems in Sink Valley (where substantial alluvial groundwater systems are present) have been performed in conjunction with permitting activities for the existing Coal Hollow Mine. In conjunction with these activities, many monitoring wells have been constructed in the tract and adjacent area (Table 3.16.4).

Table 3.16.4. Information for Wells in and Adjacent to the Alton Coal Tract

Well ID*	Year Completed	Location	Screened Formation	Well Elevation (feet)	Well Depth (feet)	Typical Depth to Water (feet)†
CO-18	2007	SW¼ of SE¼, Section 19, Township 39 South, Range 5 West	Alluvium	6,864	22	15
CO-54	2007	SW¼ of SE¼, Section19, Township 39 South, Range 5 West	Tropic Shale	6,860	54	27
C1-24	2007	NW¼ of SW¼, Section 20, Township 39 South, Range 5 West	Alluvium	6,949	27	13
C2-15	2007	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	15	11
C2-28	2007	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	28	10
C2-40	2007	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	40	10
C3-15	2007	SW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	15	5
C3-30	2007	SW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	28	5
C3-40	2007	SW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	40	5
C4-15	2007	NW¼ of SW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,874	15	5
C4-30	2007	NW¼ of SW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,874	30	5
C4-50	2007	NW¼ of SW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,874	50	4
C5-130	2007	SE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,939	130	-23
C6-15	2007	NE¼ of NE¼, Section 30, Township 39 South, Range 5 West	Alluvium/Tropic Shale	6,898	15	Dry
C7-20	2007	SE¼ of NE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,873	20	10
C8-25	2007	NE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,860	27	7
C9-15	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,847	15	9
C9-25	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,846	26	9
C9-40	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,847	42	10
LR-45	2007	NW¼ of NW¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,798	42	28
LS-15	2007	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,810	15	8
LS-28	2007	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,810	28	7
LS-60	2007	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,810	60	5

Table 3.16.4. Information for Wells in and Adjacent to the Alton Coal Tract

Well ID*	Year Completed	Location	Screened Formation	Well Elevation (feet)	Well Depth (feet)	Typical Depth to Water (feet)†
LS-85	2007	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,811	87	-3
SS-15	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,832	15	5
SS-30	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,830	29	4
SS-75	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium/burned coal	6,832	75	15
UR-70	2007	NW¼ of SW¼, Section 20, Township 39 South, Range 5 West	Alluvium	7,005	70	23
Y-36	1979	NE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Smirl Coal Zone	6,957	214	84
Y-38	1979	NE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Smirl Coal Zone	6,862	86	55
Y-39	1979	SE¼ of SW¼, Section 30, Township 39 South, Range 5 West	Smirl Coal Zone	6,850	12	Dry
Y-40	1979	NW¼ of NE¼, Section 31, Township 39 South, Range 5 West	Smirl Coal Zone	6,881	70	71
Y-41	1979	SE¼ of NE¼, Section 31, Township 39 South, Range 5 West	Smirl Coal Zone	6,844	64	49
Y-43	1979	SE¼ of NW¼, Section 30, Township 39 South, Range 5 West	Smirl Coal Zone	6,868	42	42
Y-45	1980	NE¼ of NE¼, Section 29, Township 39 South, Range 5 West	Smirl Coal Zone	7,045	330	250
Y-47	1980	NW ¼ of SW ¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,867	46	14
Y-48	1980	NW¼ of SW¼, Section 29, Township 39 South, Range 5 West	Smirl Coal Zone	6,867	128	30
Y-49	1980	NE¼ of NE¼, Section 30, Township 39 South, Range 5 West	Smirl Coal Zone	6,872	102	41
Y-50	1980	NE¼ of NE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,872	31	11
Y-53	1980	SE¼ of NE¼, Section 19, Township 39 South, Range 5 West	Smirl Coal Zone	7,002	210	179
Y-55	1980	SW¼ of SW¼, Section 12, Township 39 South, Range 6 West	Smirl Coal Zone	6,949	69	68
Y-56	1980	SW¼ of SW¼, Section 12, Township 39 South, Range 6 West	Alluvium	6,892	40	4
Y-57	1980	NE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,964	70	-10
Y-58	1980	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,950	90	-10
Y-59	1980	SE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,962	110	-18
Y-61	1980	NE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,962	150	-10

Table 3.16.4. Information for Wells in and Adjacent to the Alton Coal Tract

Well ID*	Year Completed	Location	Screened Formation	Well Elevation (feet)	Well Depth (feet)	Typical Depth to Water (feet)†
Y-62	1980	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,817	110	-10
Y-63	1980	SW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,789	51	13
Y-69	1985	NE¼ of SE¼, Section 11, Township 39 South, Range 6 West	Smirl Coal Zone	6,950	53	10
Y-70	1985	NE¼ of NE¼, Section 13, Township 39 South, Range 6 West	Smirl Coal Zone	6,900	87	38
Y-98 (A1)	1986	NW¼ of NW¼, Section 21, Township 39 South, Range 5 West	Alluvium	7,174	86	84
Y-99 (A2)	1986	NE¼ of SW¼, Section 20, Township 39 South, Range 5 West	Alluvium	7,056	22	Dry
Y-100 (A3)	1986	NW¼ of SE¼, Section 20, Township 39 South, Range 5 West	Alluvium	7,083	131	75
Y-101 (A4)	1986	NE¼ of SW¼, Section 20, Township 39 South, Range 5 W.	Alluvium	7,017	77	22
Y-102 (A5)	1986	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,950	86	-6
Y-103 (A6)	1986	NW¼ of NW¼, Section 18, Township 39 South, Range 5 West	Alluvium	6,920	78	31
Nevada Power No. 1	1961	SW¼ of NW¼, Section 18, Township 39 South, Range 5 West	Navajo Sandstone	6,900	1,600	Not available
Nevada Power No. 2	1961	SE¼ of NW¼, Section 30, Township 39 South, Range 5 West	Navajo Sandstone	6,850	1,140	432
CHM Water Supply Well	2010	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,961	51	-16

*Some wells are no longer operative.

† Negative values indicate artesian pressure.

Sources: ACD (2013), DOGM (2013a), Petersen Hydrologic (2013), UII (1987a), Doelling et al. (1972), and UDNR (1981).

Alluvial deposits in the tract exist primarily within the narrow stream valleys, which are surrounded by and underlain by low-permeability bedrock units (see Map 3.10). The presence of the surrounding low-permeability bedrock impedes the potential for outflow of alluvial groundwater into surrounding bedrock units. Consequently, the directions of groundwater flow in shallow, unconfined alluvial groundwater systems in the narrow valleys follow the directions of the associated stream valleys that contain the alluvial deposits. Similarly, the hydraulic gradients in the shallow, unconfined alluvial groundwater systems within the narrow valleys also likely mirror the hydraulic gradients of the stream valleys that contain them. Laterally within the tract, the alluvium deposits range from a thin covering to a thicker covering of 10 feet or more. Groundwater naturally discharges to the surface as springs and seeps from alluvial deposits, the Dakota Formation, and weathered Tropic Shale.

Thirteen springs and seeps on and immediately adjacent to the tract have been monitored for water quantity and quality (Table 3.16.5). Additionally, a zone of alluvial groundwater seepage into the Lower Robinson Creek stream channel has been monitored. At 10 of these locations, sufficient water has been present (on at least one occasion) to allow collection of spring discharge samples for laboratory water quality analysis. At most locations in the tract, discharge rates from these springs and seeps are meager, and water quality is often poor (with TDS concentrations commonly exceeding 2,000 mg/L) (Petersen Hydrologic 2013). As a consequence, the potential for use of this groundwater resource is limited (see Table 3.16.5).

Table 3.16.5. Discharge and Water Quality Information for Springs and Seeps in the Tract

Spring/Seep	Block Location	Flow Range (gpm)	Maximum Specific Conductance (µS/cm)	Minimum TDS (mg/L)	Maximum TDS (mg/L)	Suitable for Irrigation Use (1,200-mg/L criteria)	Suitable for Stock Watering Use (2,000-mg/L criteria)
Spring 1 (Pond Spring)	NW	12.3–17.5	2,710	2,190	2,420	No	No
Spring 2 (Hill spring)	NW	1.2–2.3	3,450	3,020	3,250	No	No
Seep 1 (Alkali Seep)	CWN	< 0.5	6,160	2,790	3,250	No	No
Seep 2 (April Seep)	NW	< 0.5	9,200	7,360	9,160	No	No
Seep 3 (Car Seep)	NW	< 0.5	2,180	1,450	1,680	No	Yes
SP-41 (Dakota Seep)	CWS	0	–	–	–	–	–
Seep 4 (Priscilla Seep)	NW	< 0.5	11,180	12,200	12,600	No	No
Seep 6 (Seep Y)	NW	< 0.5	15,430	–	–	–	–
Seep 7 (Seep Z)	NW	< 0.5	7,950	6,560	6,560	No	No
SP-27 (Clampett Seep)	S	< 0.5	5,070	3,780	6,550	No	No
SP-38 (south swale alk)	S	< 0.5	17,910	4,400	14,900	No	No
SP-39 (Seep in CHM area)	C	< 0.5	2,640	–	–	–	–

µS/cm = micro-Siemens per centimeter.

The Tropic Shale bedrock consists predominantly of marine shale and claystone with very low permeability (see 3.16.2.1.1). The quality of groundwater that has interacted with Tropic Shale bedrock (or Tropic Shale–derived unconsolidated deposits) is usually poor, which further limits its potential for use. Consequently, the Tropic Shale has no appreciable potential as a developable groundwater resource. The Dakota Formation, which consists predominantly of interbedded lenticular sandstones, shales, and coal deposits, underlies the Smirl Coal Zone to be mined (Petersen Hydrologic 2007). Due to the low permeability of these units, groundwater from the Tropic Shale and Dakota Formation does not contribute measurable baseflow to streams in the tract (Petersen Hydrologic 2007). However, springs and seeps in and adjacent to Block NW do contribute appreciably to the baseflow in Simpson Hollow Creek. Table 3.16.4 includes information on developed wells in and adjacent to the tract. Although shallow groundwater resources are present beneath the tract, most of these groundwater resources are not supportive of a readily developable groundwater resource due to low permeability or limited extent of the associated geologic units. Accordingly, no water production wells are present in the tract. Although permeable alluvial deposits are present within narrow stream valleys in some portions of the tract, these deposits are generally limited in both vertical and aerial extent (Tilton 2001). These localized alluvial deposits would likely not support appreciable developable groundwater resources. However, a water well screened in saturated alluvial sediments adjacent to Kanab Creek approximately 0.8 mile north of the tract was developed by the town of Alton for municipal use. Additionally, appreciable alluvial groundwater resources are present in Sink Valley (southeast of the tract) where thicker sequences of alluvial deposits (up to 150 feet thick) are present and flowing artesian conditions exist in the alluvial groundwater system (Petersen Hydrologic 2007).

Currently, groundwater is being extracted from a well in the Sink Valley alluvial groundwater system for use at the Coal Hollow Mine. No water supply wells are known to exist in either the Tropic Shale or the Dakota Formation in the tract, demonstrating the inability of these formations to transmit useful quantities of water to wells. There is no indication of any successful historical development of groundwater resources in the Dakota Formation locally, even though it is present at or near the surface in many locations in and adjacent to the tract (see Map 3.10). This is likely due to the reported poor potential for groundwater to migrate vertically or horizontally over substantial distances through the Dakota Formation (Petersen Hydrologic 2007). It is unlikely that appreciable groundwater resources could be developed in the Dakota Formation.

The first significant quantities of groundwater underlying the tract are from the deep Navajo Sandstone aquifer. On a regional scale, groundwater from the Navajo Sandstone is used for domestic, agricultural, and municipal wells. This groundwater also provides baseflow to springs and streams in the region. However, the Navajo Sandstone aquifer is not tapped by any operating wells in or adjacent to the tract. In the early 1960s, Nevada Power Company drilled two large diameter wells into the Navajo Sandstone to depths of approximately 1,400 and 1,600 feet in an attempt to develop groundwater. Neither well obtained sufficient water at the final depth to be considered even moderately successful (Doelling et al. 1972). Within the tract, the depth of the Navajo Sandstone ranges from approximately 1,300 to 2,450 feet below land surface (see Figure 3.6.1b). Therefore, the groundwater resources available in the Navajo Sandstone aquifer are not reasonably available for development near the tract because of the high costs of well construction and groundwater pumping. The Navajo Sandstone aquifer is effectively isolated from the proposed mining areas in the tract by more than 1,000 feet of low-permeability rock strata of the Dakota and Carmel formations. These formations contain large thicknesses of low-permeability shales, siltstones, mudstones, and bentonite. Therefore, the Navajo Sandstone aquifer is not further evaluated.

During the period of operation at the adjacent Coal Hollow Mine, only limited amounts of groundwater have been intercepted by the mine pits (ACD, permit files at DOGM [2013]). Typically, the total inflow of intercepted groundwaters from all sources into the mine pit area at any one time has not exceeded approximately 25 gpm. Over the operational history of the Coal Hollow Mine, most of the groundwater encountered in the pit areas has originated from areas where saturated fluvial channel sediments are exposed in the mine highwall. At any given time, the combined inflow rates from intercepted alluvial groundwater systems in the pit areas have typically been on the order of 20 gpm or less. The rates of inflow of groundwater from the Tropic Shale bedrock where it is exposed in the pit walls (beneath the alluvium and above the coal seam) have been minimal (generally less than 1 gpm). Minor seepage of groundwater from the Smirl Coal Zone into the mine pit areas has been observed. These inflows, which have typically occurred when the coal seam was first exposed in the mine pit floor, have been estimated at 1–2 gpm typically. Under normal operating conditions at the existing Coal Hollow Mine, most of the water intercepted in the mine pit areas has been used for dust-suppression activities, and discharge of water from the mine has not been necessary.

3.16.2.1 BLOCK C

3.16.2.1.1 Groundwater Occurrence and Use

In Block C, only limited amounts of groundwater naturally discharge to the surface as seeps and springs.

Groundwater discharge within this block has been identified at a single seep and also as streambed and streambank seepage along Lower Robinson Creek. SP-39 is in the currently permitted surface-disturbance area of the Coal Hollow Mine in the southeast portion of Block C (see Map 3.17). The discharge monitored at this spring has been meager, ranging from a maximum of less than 0.05 gpm to damp soil only. This seep is believed to be associated with shallow, seasonal snowmelt waters migrating through the shallow subsurface, and does not appear to be associated with a substantial groundwater system (see Appendix F). The limited quantity of water at the seep is principally used by wildlife. The potential for stock watering use at the seep is minimal because of the small quantity of water available.

Seepage of alluvial groundwater into the streambed and streambanks in Lower Robinson Creek near the south boundary of Block C (along the south border of Section 19, Township 39 South, Range 6 West) occurs. This groundwater seepage occurs where the alluvial groundwaters in saturated alluvial sediments surrounding the stream channel are forced to the surface at the intersection of the stream channel and the underlying low-permeability bedrock atop the Dakota Formation (see Appendix F). The alluvial seepage water in Lower Robinson Creek (which is monitored at BLM-1 and SW-5) commonly persists in the stream channel to the confluence with Kanab Creek. At other times, the water is lost to evapotranspiration or infiltrates the gravelly Lower Robinson Creek channel substrate near the confluence with Kanab Creek. Water in this reach of the stream is used by wildlife and for stock watering directly along the stream.

As measured at well Y-53C, which is screened in the Smirl Coal Zone in the upland, east portion of Block C, the depth to groundwater in this area has ranged from approximately 176 to 184 feet below the land surface (Petersen Hydrologic 2013). Thick alluvial sediments, which could support shallow alluvial groundwater systems in the upland areas, are generally not present in the upland areas of Block C (Petersen Hydrologic 2013; Tilton 2001).

In the alluvial sediments adjacent to Lower Robinson Creek in Block C, water levels in the southeast portion of Block C (see sites LR-45, Y-101P, and UR-70) are generally within approximately 20–30 feet of the ground surface (DOGM 2013b; Petersen Hydrologic 2013). In lower-lying locations outside the coal zone in the west and south portions of Block C, the Dakota Formation and quaternary alluvium are present at the land surface (see Map 3.10). The Dakota Formation consists predominantly of interbedded claystones, shales, siltstones, and sandstones, and generally has poor water-transmitting characteristics (Petersen Hydrologic 2007). No appreciable Dakota Formation springs have been identified in this area. The quaternary alluvial sediments exposed in erosional escarpments along Kanab Creek consist primarily of clays and silts, with lesser amounts of sand and gravels (Petersen Hydrologic 2013). Seepage of appreciable amounts of groundwater from the exposed alluvial sediments adjacent to Kanab Creek within Block C has not been observed. Likewise, appreciable gains in stream discharge rates in Block C during baseflow conditions have not been observed (see Figure 3.16.4), suggesting a lack of groundwater discharge from either the Dakota Formation or the alluvial sediments adjacent to Kanab Creek in the Block C area.

3.16.2.1.2 Groundwater Hydrology

Only limited quantities of groundwater naturally discharge in Block C. Within the block, only one spring (SP-39, which discharges at less than 0.05 gpm) and the alluvial seepage zone in the lower reaches of the Lower Robinson Creek stream channel (which typically discharges at less than about 7 gpm) have been identified. The lack of appreciable groundwater discharge over most of the block is likely attributable largely to the presence of the Tropic Shale at or near the land surface over much of Block C (see Map 3.10). The Tropic Shale is a regionally extensive formation that mostly consists of soft, low-permeability marine shales (see Section 3.6). Locally, the alluvial deposits in Block C consist largely of clayey sediments derived from the weathering and transport of clayey sediments sourced from the Tropic Shale. Accordingly, snowmelt waters and precipitation waters falling on the formation tend to run off as surface water to receiving drainages rather than infiltrating into the subsurface as groundwater recharge. To quantify the permeability of the Tropic Shale, a drilling core consisting of unweathered Tropic Shale was analyzed at the laboratory for coefficient of permeability (the core sample was remolded and compacted at the laboratory prior to the analysis). The low laboratory result for the coefficient of permeability (8.24×10^{-8} cm per second) supports the conclusion that the potential for groundwater migration through the Tropic Shale is low. The pervasive presence of the Tropic Shale and Tropic Shale–derived clayey sediments 1) minimizes the potential for vertical groundwater recharge to the unit and to deeper, underlying geologic formations; and 2) minimizes the potential for appreciable lateral or vertical flow of groundwater through the formation to potential discharge locations.

As previously described, seepage of alluvial groundwater into the streambed and streambanks in the lower reaches of Lower Robinson Creek occurs near the south boundary of Block C. This groundwater seepage occurs where the alluvial groundwaters in saturated alluvial sediments surrounding the stream channel are forced to the surface where the stream channel intersects the underlying low-permeability bedrock at the top of the Dakota Formation (see Appendix F). The alluvial seepage water in Lower Robinson Creek commonly persists in the stream channel to the confluence with Kanab Creek. At other times, the water is lost to evapotranspiration or infiltrates into the gravelly Lower Robinson Creek channel substrate near the confluence with Kanab Creek.

Unlike conditions in Sink Valley to the southeast (where many springs discharge and flowing artesian wells are present), no appreciable spring discharge has been identified in the alluvial sediments north of the Lower Robinson Creek drainage. This condition is likely related to the lack of any major surface-water drainages emanating from the Paunsaugunt Plateau east of Block C that could provide recharge to alluvial groundwater systems. (Several substantial surface-water drainages, including Lower Robinson Creek, Water Canyon, and Swapp Hollow, emanate from the Paunsaugunt Plateau east of Sink Valley.)

3.16.2.1.3 Groundwater Quality

Only a single seep has been identified in Block C. The discharge from SP-39 is meager, and standing water sufficient to measure field water-quality parameters was present on only one occasion. At that time, the discharge was estimated to be less than 0.05 gpm. The specific conductance of the groundwater was 2,640 micro-Siemens per centimeter (μS/cm). The temperature of the mostly stagnant water was 14.1°C, and the pH was 7.76. The specific conductance value measured at the seep (which is elevated relative to waters in Sink Valley) is attributable to interactions with the Tropic Shale sediments near the seep location.

The alluvial groundwater seepage that is present in the lower reaches of Lower Robinson Creek has routinely been monitored at monitoring site SW-5 and also at BLM-1. During times when ephemeral discharge is present in the drainage, the alluvial groundwater seepage is inundated by upstream surface water, and the chemical composition measured in the creek is not representative of the chemical composition of the alluvial seepage water. TDS concentrations of alluvial groundwater seepage at BLM-1 range from 867 to 1,320 mg/L, averaging 1,133 mg/L. The alluvial seepage groundwater in Lower Robinson Creek is commonly of the magnesium-bicarbonate-sulfate chemical type.

The TDS concentrations of groundwater monitored at well UR-70, which is screened in Tropic Shale–derived alluvial sediments adjacent to Lower Robinson Creek, have ranged from 4,046 to 5,208 mg/L, averaging 4,882 mg/L. The water at UR-70 is of the mixed cation-sulfate chemical type. It is noteworthy that the groundwater sampled at UR-70 is similar in composition to the surface water sampled in Lower Robinson Creek during low-flow conditions (DOGM 2013a).

3.16.2.2 BLOCK NW

3.16.2.2.1 Groundwater Occurrence and Use

Eight springs and seeps in and immediately adjacent to Block NW have been identified and monitored for discharge rates and water quality (see Table 3.16.5; Petersen Hydrologic 2013). These include Spring 1, Spring 2, Seep 2, Seep 3, Seep 4, Seep 6, and Seep 7 (see Map 3.17). Of these eight springs and seeps, all but Seep 4 discharge from the no-coal zone (see Map 3.17). Seep 4 discharges as shallow, diffuse seepage from weathered Tropic Shale and/or Tropic Shale–derived clayey soils.

The presence of saturated near-surface sediments and soils in the spring and seep areas and also in regions topographically below irrigated fields suggests high water table conditions in these areas. Water levels in monitoring well Y-56, which is screened in alluvial sediments in Block NW, are within approximately 5 feet of the land surface.

Spring 1, which discharges from the southwest portion of Block NW, has the highest discharge rate of any spring in the tract, ranging from 12.3 to 17.5 gpm. The discharge from this spring flows into the reservoir below the spring area. Stock watering also occurs directly from the spring area at Spring 1, although the TDS concentrations of water from this spring are consistently above 2,190 mg/L, which exceeds the 1,200-mg/L stock watering standard. Measurable discharge from Spring 2 has also always been present during monitoring events at the spring. Discharge rates measured at Spring 2 have ranged from 1.15 to 2.34 gpm, averaging 1.68 gpm. Discharge from Spring 2 flows to small stock watering ponds immediately below the spring area. The TDS concentrations measured in water from Spring 2 have always exceeded the 1,200-mg/L irrigation standard, ranging from 3,020 to 3,250 mg/L.
Measurable discharges are rarely present at any of the other six springs monitored in Block NW, and the water quality characteristics at these springs are highly variable. Seep 4 discharges at low rates from the northeast portion of Block NW in the Smirl Coal Zone (see Map 3.17). The seepage area is situated topographically below a large irrigated hay field. During the four monitoring events at Seep 4, the discharge did not exceed 0.25 gpm. Discharge from Seep 2 is also meager. During five monitoring events at the seep, measurable discharge was not observed, but rather only wet soil and a few small puddles have occasionally been present there. In most instances, groundwater discharge at the six low-flow springs consists of slow, diffuse seepage that is not measurable. The TDS concentrations of waters sampled at these six seeps has ranged from 1,450 to 14,900 mg/L. The low-flow rates and elevated TDS concentrations of these waters greatly limit the potential for irrigation or stock watering use at these seeps (see Table 3.16.4). Ultimately, these spring waters flow southward to Simpson Hollow Creek and enter Kanab Creek in the northwest quarter of Section 24, Township 39 South, Range 6 West. In this area, Kanab Creek is diverted into transmission ditches that store the water in earthen ponds for irrigation.

3.16.2.2.2 Groundwater Hydrology

Although discharge from Spring 1 averages 14.6 gpm and the discharge from Spring 2 averages 1.7 gpm, measurable discharges from the other springs are rare and usually meager (usually less than 0.1 gpm). Additionally, zones of increased vegetation and saturated ground are present south of the irrigated fields within Block NW (Frontier Corporation USA 2012).

The precise mechanisms controlling groundwater recharge and groundwater discharge characteristics in Block NW are not known. The potential for the vertical or lateral migration of appreciable quantities of water through unweathered shale or clay deposits in the Tropic Shale or Dakota Formation is low. However, it is possible that groundwater flows to some of the spring areas through fractured sandstone channel deposits (which are visible at the surface near several of the seepage locations). Although groundwater flow through sandstone channels in the Dakota Formation occurs, because of the lenticular, discontinuous nature of permeable and impermeable strata in the Dakota Formation, the potential for the Dakota to transmit appreciable quantities of groundwater over considerable distances is limited. It is likely for this reason that groundwater discharge from the Dakota Formation is very limited over the tract. The potential for groundwater recharge and groundwater flow in Block NW may also be enhanced locally as a result of increased bedrock hydraulic conductivity associated with coal burn in areas where the coal seam is burned. Such burned zones are common in the Alton Coal Field near coal seam outcrop areas or in locations where the coal seam is present in the shallow subsurface.

The precise recharge and discharge mechanisms for the two springs with the most substantial discharge in Block NW (Springs 1 and 2) have not been determined. However, the discharge hydrographs for both springs show similar and rapid responses to seasonal recharge events (Figure 3.16.10). Although the magnitude of the flow rates at the two springs are dissimilar, and solute compositions of the water discharged at these two springs are somewhat variable, the notable similarity of the discharge hydrographs suggests similar mechanisms. The recharge location(s) for the groundwater systems that support Pond Spring are not known. However, possible recharge mechanisms include 1) the infiltration of irrigation waters in nearby upgradient agricultural fields, and/or 2) the infiltration of the sometimes copious amounts of late-winter and early-spring snowmelt that occurs in the area.

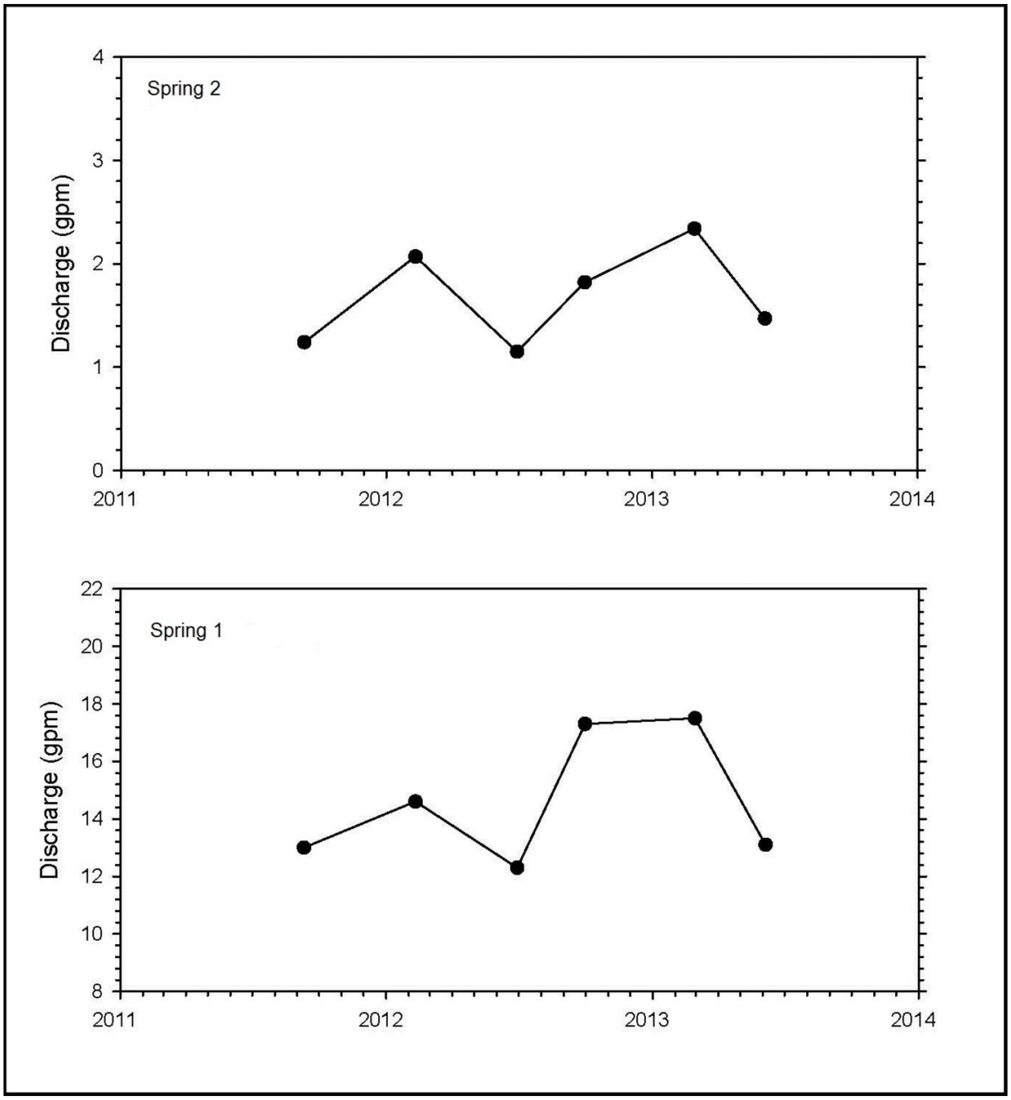

Figure 3.16.10. Discharge hydrographs for Springs 2 and 1.

3.16.2.2.3 Groundwater Quality

The water quality characteristics of the eight springs and seeps monitored in the Block NW area are variable. Generally, the TDS concentrations of springs and seeps are elevated, and the spring water does not meet state standards for irrigation (1,200 mg/L) or stock watering (1,200 mg/L) (Petersen Hydrologic 2013). Spring water sampled from Spring 1, which discharges from the southwest portion of Block NW and has the highest discharge rate of any in the tract (average 14.6 gpm), has TDS concentrations ranging from 2,190 to 2,420 mg/L, averaging 2,190 mg/L. The water at Spring 1 is of the magnesium-sulfate geochemical type. Spring 2, which discharges at approximately 1.7 gpm on average, has measured TDS concentrations ranging from 3,020 to 3,250 mg/L, averaging 3,133 mg/L. The water at Spring 2 is of the mixed-cation-sulfate geochemical type. TDS concentrations measured at the other six seeps are variable, ranging from 1,450 mg/L at Seep 3 to 12,600 mg/L at Seep 4. As indicated in Table 3.16.5, the Utah TDS standard for irrigation water (1,200 mg/L) and the standard for stock watering (1,200 mg/L) are usually not met in groundwaters in Block NW. Most groundwaters sampled in Block NW are of the magnesium-sulfate geochemical type. The geochemical evolution resulting in the magnesium-sulfate geochemical type in groundwater at Block NW is not known. However, the dissolution of epsomite ($MgSO_4 \cdot 7H_2O$) is a possible source for the magnesium and sulfate in the water.

3.16.2.3 BLOCKS CWN AND CWS

3.16.2.3.1 Groundwater Occurrence and Use

No appreciable groundwater discharge has been observed in Block CWS (Petersen Hydrologic 2007). A single seep area (SP-41) has been identified near Block CWS in Dakota Formation sediments outside the coal zone. Measurable discharge has never been observed at this seep. Rather, only damp soil has occasionally been present. A high water table condition and associated vegetation were noted in a small (0.20 acre) portion of an ephemeral wash along the west boundary of Block CWS (Frontier Corporation USA 2012). However, no water at the surface was present in this location. Historically, when mining occurred at the Alton Mine in the Smirl Coal Zone in Block CWS, the mine was noted as being dry (Doelling and Graham 1972). There are no known uses of groundwater resources in Block CWN.

Similarly, no appreciable groundwater discharge has been observed in Block CWN (Petersen Hydrologic 2013). A single groundwater seep (Seep 1) has been identified near Block CWN in Dakota Formation sediments outside the coal zone. Measurable discharge has not been observed at this seep, although small stagnant pools of water are usually present at the seep area. The TDS concentrations of water monitored at Seep 1 have ranged from 2,790 to 3,250 mg/L (Petersen Hydrologic 2013), which exceeds both the 1,200-mg/L irrigation standard as well as the 1,200-mg/L stock watering standard. The meager quantities of water present at the seep and the poor water quality characteristics greatly limit the potential for use of this water.

3.16.2.3.2 Groundwater Hydrology

Blocks CWN and CWS are isolated bedrock hills that rise above the surrounding lowland regions (see Map 1.2). The Smirl Coal Zone outcrops along the perimeters of the hills, isolating the coal zone from surrounding strata. The isolated hills are capped by low-permeability Tropic Shale bedrock, which greatly limits the potential for vertical recharge to the coal zone or underlying strata. Because of the lack of vertical recharge potential, and because the rock strata are truncated by erosional escarpments along the margins of the hills, there are likely no appreciable groundwater systems present at or above the level of the coal seam in Blocks CWN and CWS. The Alton Mine, which operated within Block CWS in the 1960s, was noted as being a dry mine (Doelling and Graham 1972), further supporting this conclusion.

Minor diffuse groundwater seepage does occur from the Dakota Formation in the no-coal zone surrounding both Block CWN and CWS. Very small amounts of groundwater seep from the lower northeast hillside at SP-41. No measurable flow has been observed at SP-41, rather only wet soil. A single seep (Seep 1) has also been identified adjacent to Block CWN in the no-coal zone. Seep 1 discharges at very low rates from the lower eastern hillside in the no-coal zone. Measurable discharge at Seep 1 has not been observed, although stagnant puddles are usually present.

3.16.2.3.3 Groundwater Quality

There are no appreciable groundwater systems in the Block CWN and CWS areas. The TDS concentrations measured at Seep 1, which is in the no-coal zone adjacent to Block CWS, range from 2,790 to 3,250 mg/L. These concentrations exceed both the irrigation standard and the stock watering standard for TDS.

3.16.2.4 BLOCKS S AND SA

3.16.2.4.1 Groundwater Occurrence and Use

Two seep areas have been identified in and immediately adjacent to Blocks S and Sa. These include SP-38 and SP-27. SP-38 discharges from clayey sediments near the mouth of an ephemeral drainage in the no-coal zone in the south portion of Blocks S and Sa (see Map 3.17). Flowing water is only rarely present at SP-38. However, small isolated puddles are sometimes present. The water quality measured at SP-38 is poor, with TDS concentrations ranging from 4,400 to 14,900 mg/L at the spring (which greatly exceed both the 1,200-mg/L state irrigation standard and the 1,200-mg/L state stock watering standard). Accordingly, because of the small quantity of water available at the spring and its poor quality, the potential for use of water at SP-38 is low.

SP-27 is on the southeast border of Block S and Sa. The seep discharges at low rates from weathered strata near the outcrop of the Smirl Coal Zone. Discharge has only rarely been observed at SP-27 (Petersen Hydrologic 2013) and, when discharge has occurred, the flow rates have not exceeded 0.5 gpm. The water quality measured at SP-27 has been poor, with TDS concentrations ranging from 3,780 to 6,550 mg/L (which greatly exceed both the 1,200-mg/L state irrigation standard and the 1,200-mg/L state stock watering standard). It was noted that the water sampled at SP-27 in June 2005 was black in color. Because of the low flow rates and poor water quality characteristics of water at SP-27, there is little potential for use of this water.

3.16.2.4.2 Groundwater Hydrology

Blocks S and Sa are in the upland region between Sink Valley on the east and the Kanab Creek valley on the west. Because these upland areas are topographically higher than are the surrounding lowlands, recharge to shallow groundwater systems likely occurs through direct infiltration of precipitation and snowmelt waters in the area. Because the low-permeability Tropic Shale and Dakota Formation are present at the surface over almost the entire land surface in Blocks S and Sa (see Map 3.10), groundwater recharge rates are likely low.

SP-38 discharges from clayey sediments near the mouth of an ephemeral wash in the no-coal zone in the south portion of Blocks S and Sa (see Map 3.17). Discharge from the spring is present only intermittently, and the spring is commonly dry or nearly dry (with damp clayey soils usually being present). When present, discharge is typically less than approximately 0.5 gpm. SP-38 discharges from shallow, near-surface sediments at the mouth of the narrow wash. The intermittent nature of the flow at SP-38 and the fact that the spring emanates from the shallow near-surface sediments suggest a shallow, seasonal recharge source for the groundwater at the spring. These factors indicate that the spring recharges in areas to the north, where precipitation runoff and snowmelt waters are concentrated in the wash.

SP-27 discharges from the hillside on the east boundary of Blocks S and Sa (see Map 3.17). The discharge location for the seep is near the outcrop of the Smirl Coal Zone. Discharge is only rarely present, and the hillside is usually completely dry during drought years. Measured seep flows have not exceeded 0.5 gpm. These factors suggest a shallow, climate-dependent recharge source.

There is an isolated hill in the west portion of Blocks S and Sa that is similar to the two hills in the CWS and CWN blocks described previously (see Map 1.2). Because the coal seam is truncated by erosional escarpments around the hill and is capped with low-permeability Tropic Shale bedrock, which minimizes the potential for vertical recharge, it is likely that there is no appreciable groundwater system near this isolated hill.

Information from water monitoring wells in Blocks S and Sa indicates depths to water of several tens of feet in this area. Several wells screened in the Smirl Coal Zone indicate the presence of water at approximately 50 feet below the ground surface (there is little or no alluvium at most drill hole locations and drilling logs indicate that appreciable water was not encountered in the bedrock overburden strata above the Smirl Coal Zone) (UII 1987a). Some monitoring wells completed in the Smirl Coal Zone in Block S and Sa have historically been dry (Petersen Hydrologic 2013; UII 1987a). Several water-monitoring wells completed in alluvial sediments along the western margins of Sink Valley adjacent to the southeaster border of Block S and Sa indicate depths to water ranging from approximately 0 to 10 feet (DOGM 2013b).

3.16.2.4.3 Groundwater Quality

The groundwater resources in the Block S and Sa area are meager. Measurable discharge from the two seeps identified in and immediately adjacent to the blocks is only rarely present. No alluvial groundwater systems have been identified in Block S and Sa. TDS concentrations range from 4,400 to 14,900 mg/L at SP-38 (which greatly exceed both the 1,200-mg/L state irrigation standard and the 1,200-mg/L state stock watering standard). The water at SP-38 is of the sodium-sulfate geochemical type. TDS concentrations measured at SP-27 have ranged from 3,780 to 6,550 mg/L (which greatly exceed both the 1,200-mg/L state irrigation standard and the 1,200-mg/L state stock watering standard). It was noted that the water sampled at SP-27 in June 2005 was black in color. The water at SP-27 is of the sodium-bicarbonate geochemical type, with substantial sulfate concentrations.

3.16.2.5 SINK VALLEY

3.16.2.5.1 Groundwater Occurrence and Use

Based on estimates provided by Petersen Hydrologic (2010), approximately 10,000 acre-feet of groundwater are available in the zone (generally alluvial sediments) from which groundwater resources could be extracted from Sink Valley Wash alluvial groundwater systems. This is a first-order approximation of the available alluvial groundwater resource in Sink Valley that is based on conservative assumptions, including 1) an aerial extent of approximately 1.5 square miles, 2) an average saturated thickness of approximately 45 feet, and 3) an average effective porosity value of approximately 0.25 (porosity values are unitless and are the ratio of interconnected pore spaces to the volume of the rock or sediment). Although tritium and radiocarbon dating of the alluvial groundwaters in Sink Valley indicate modern (post-1951) recharge (Petersen Hydrologic 2007), the rate at which recharge to the alluvial groundwater system occurs has not been determined.

3.16.2.5.2 Groundwater Hydrology

The alluvial deposits in Sink Valley approach a thickness of 50 feet, and are reported to be 120–140 feet thick along the east edge of the valley (Petersen Hydrologic 2007). The alluvial deposits in Sink Valley are also capped by a thick sequence (up to 60 feet) of clayey material. Also unique to Sink Valley is the presence of the Tropic Shale along its margins that creates a hydrogeologic boundary that, in essence, creates a “bathtub” in the valley (UII 1987b). Furthermore, Sink Valley is at the base of numerous drainages (Petersen Hydrologic 2007) that are recharged from the Paunsaugunt Plateau. Therefore, numerous springs and wells are in Sink Valley, a groundwater discharge area. See Section 3.16.3.4 for discussion of AVFs.

Because groundwater discharge from Sink Valley does not support measurable baseflow in the ephemeral Sink Valley Wash south of the tract (Petersen Hydrologic 2007), it follows that baseflow discharge from Sink Valley does not contribute to surface-water flows in Kanab Creek. (Sink Valley Wash flows into Kanab Creek approximately 5.5 miles south of the tract [see Map 3.17]).

3.16.2.5.3 Groundwater Quality

Groundwater quality data are available for 11 wells and 26 springs near the southeast border of the tract. All these sampling sites are in or near Sink Valley (see Map 3.17), and are not representative of groundwater conditions in the entire tract. Groundwater quality data for the 11 wells and 26 springs are listed in Table 3.16.6 for select parameters. These data are summarized from data obtained from the DOGM water quality database. Groundwater quality data for TDS are available for six wells and 10 spring monitoring sites near the southeast border of the tract. All of these sampling sites are in or near Sink Valley Wash. The average TDS concentrations measured in groundwater from wells and springs in Sink Valley Wash are 623 and 394 mg/L, respectively. These concentrations are well below the state standard for irrigation and stock watering. Groundwater collected from a well (Y-36) completed in the Smirl Coal Zone had a TDS concentration of 1,320 mg/L. This TDS result slightly exceeds the state standard for irrigation; however, only one sample result was available. The average selenium concentration measured in groundwater from all wells and springs was less than laboratory detection limits (typically 0.001–0.02 mg/L). The average boron concentration measured in groundwater from all wells and springs was 0.2 mg/L.

Table 3.16.6. Summary of Selected Groundwater Quality Data Adjacent to the Alton Coal Tract

Groundwater Source	Parameter	Minimum	Maximum	Average
Wells in Sink Valley Wash alluvium	pH	7.0	8.0	7.4
	Conductivity (µS/cm)	602	2,680	910
	TDS (mg/L)	378	2,060	623
Wells in Lower Robinson Creek	pH	6.6	7.9	7.2
	Conductivity (µS/cm)	1,622	5,490	3,365
	TDS (mg/L)	1,172	5,208	3,197
Well in the Smirl Coal Zone of Sink Valley Wash	pH	7.2	7.9	7.6
	Conductivity(µS/cm)	1,320	1,320	1,320
	TDS (mg/L)	784	815	800
Springs in Sink Valley Wash alluvium	pH	7.0	9.1	7.6
	Conductivity (µS/cm)	482	4,150	1,045
	TDS (mg/L)	381	1,182	662
Springs in Lower Sink Valley Wash	pH	7.0	7.8	7.5
	Conductivity(µS/cm)	686	2,470	1,662
	TDS (mg/L)	394	594	518

Notes: Wells in Sink Valley Wash alluvium include the following sites: C5-130, LS-15, LS-60, LS-85, SS-15, SS-30, Y-102, and Y-61.
Wells in Lower Robinson Creek include the following sites: LR-45 and UR-70.
Alluvium Sink Valley Wash Springs include the following sites: Sorenson Spring, SP-14, SP-15, SP-16, SP-17, SP-18, SP-19, SP-20, SP-21, SP-22, SP-23, SP-24, SP-25, SP-26, SP-28, SP-29, SP-30, SP-31, SP-32, SP-33, SP-35, SP-6, and SP-8.
Lower Sink Valley Wash Springs include the following sites: SP-3, SP-34, and SP-4.

3.16.3 Wetlands, Riparian Areas, Floodplains, and Alluvial Valley Floors

3.16.3.1 WETLANDS

A preliminary JD was completed in November 2012 (USACE 2012b). It concludes that approximately 54.0 acres of wetlands present in the tract are potential waters of the U.S. regulated under Section 404 of the CWA. The BLM must also comply with EO 11990 (Protection of Wetlands [May 24, 1977]), which directs federal agencies to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. In all, 24 individual wetlands areas were identified during the delineation. These wetland areas were classified into three habitat types: approximately 18.5 acres were classified as riparian wet meadow wetlands; 31.6 acres were classified as irrigated wet meadow wetlands; and 3.8 acres were classified as mixed riparian scrub-shrub/wet meadow wetlands (see Map 2.4).

Riparian wet meadows are typically found throughout the tract in topographically distinct drainage bottoms. The drainages may or may not have stream channels present. These are herbaceous vegetation communities lacking tree and shrub layers and tend to be heavily grazed. Spring runoff, surface drainage, and a seasonally high water table appear to be the main sources of hydrology for these wetlands (Frontier Corporation USA 2012).

Irrigated wet meadow wetlands basically have the same vegetation community composition as riparian wet meadow wetlands, but they do not occur in distinct drainages. Rather, these are slope wetlands found in association with drainage coming off irrigated alfalfa fields in the northwest portion of the tract. The portions of these wet meadows that are situated inside livestock exclosure fences for the alfalfa fields are not heavily grazed. Irrigation return flows, natural surface drainage, and a seasonally high water table appear to be the main sources of hydrology for these wetlands (Frontier Corporation USA 2012).

The mixed riparian scrub-shrub/wet meadow wetland type was only identified along the south reach of Kanab Creek. The creek's active floodplain in this reach is composed chiefly of cobble, gravel, and sand. These alluvial substrates have sparse amounts of soil present in scattered small depositional pockets and abandoned channel meanders. The cobble/gravel/sand areas are dominated by a scrub-shrub layer of narrow-leaf willow (*Salix exigua*), and the smaller depositional pockets and abandoned channel meanders are typically vegetated with herbaceous wet meadow species. Seasonal flooding and near-surface groundwater associated with the alluvial aquifer appear to be the main sources of hydrology for these wetlands (Frontier Corporation USA 2012).

3.16.3.2 RIPARIAN AREAS

There are approximately 55.3 acres of riparian area on the tract (approximately 1.5% of the total tract) largely along Kanab Creek and Lower Robinson Creek (see Map 3.18). Species such as willow, cottonwood, Russian olive, and tamarisk occur in the overstory of the tract's riparian communities. Understory species include wiregrass and saltgrass as well as disturbed-area weedy species such as curlycup gumweed and broom snakeweed (SWCA 2007b).

3.16.3.3 FLOODPLAINS

Approximate floodplain locations and extents in and adjacent to the tract were assessed as part of the reconnaissance-level AVF investigation conducted by Petersen (see Appendix F) described in Section 3.16.3.4 below. Petersen's investigation indicates that map-able floodplains (and associated terraces) in the tract are adjacent to Kanab Creek in the no-coal zone (see Map 3.18). The total acreage of this floodplain/terrace area in the tract is approximately 57 acres. Petersen's study area for the AVF investigation also includes areas adjacent to the tract. Kanab Creek north and south of the tract boundary also has an associated map-able floodplain/terrace complex, in addition to lower Sink Valley Wash southeast of the tract. The total approximate acreage of floodplains/terraces outside of the tract defined in the AVF investigation is approximately 476 acres. Areas mapped as floodplains and terraces include terrace areas that are outside the active floodplain areas and are generally not prone to flooding. This is likely because in most locations in the tract, Kanab Creek is deeply incised into its associated alluvial deposits. This condition has left the old, pre-incision floodplains isolated by up to several tens of feet above the current, active floodplains adjacent to the creek (i.e., the old floodplains are now considered as terrace features). In addition to the floodplains and associated terraces assessed here, approximately 57 acres of floodplains associated with essentially all of the numerous small, narrow washes distributed over the tract are also present. Floodplains are protected by EO 11988 (Floodplain Management). This EO requires federal agencies to take action to reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains.

3.16.3.4 POTENTIAL OCCURRENCE OF ALLUVIAL VALLEY FLOORS

Areas identified as AVFs are subject to special mining considerations and protections under SMCRA. The intent of these special considerations is to protect certain alluvial valleys that are of special importance to farming in the arid and semiarid western United States (west of the 100th meridian). Accordingly, it is useful to delineate areas that may be determined to be AVFs in future mine permitting activities. Under the governing State of Utah coal mining rules (R645-302: Special Categories and Areas of Mining), if AVFs are present in or adjacent to a proposed mining area, special rules apply to coal mining there. The special rules are generally more restrictive, and reclamation requirements are more stringent for AVF areas than for other areas. Specifically, mining in or adjacent to an AVF is prohibited except where it can be shown that mine-related activities will not 1) interrupt, discontinue, or preclude farming on AVFs; or 2) cause material damage to the quantity of water in surface or underground water systems that supply AVFs. Statutory exclusions from these considerations are granted where the pre-mining land use of an AVF is undeveloped rangeland that is not significant to farming, or where farming on the AVF that would be affected is of such small acreage as to be of negligible impact on a farm's production. Exclusion is also granted where significant mining at an operation occurred in or adjacent to an AVF prior to August 3, 1977.

A reconnaissance-level AVF investigation was conducted on the tract in spring 2008 (see Appendix F for the complete report). This study was intended to provide baseline information concerning potential AVFs occurring on and adjacent to the tract. The performance of detailed, site-specific AVF studies typically involves the collection and analysis of large amounts of data, and requires considerable effort and expense. Consequently, where necessary, detailed, site-specific AVF studies are typically performed during the permitting stage of mine development rather than at the leasing stage, when the successful bidder and detailed mine plans are unknown.

The identification criteria used to delineate probable AVFs in the reconnaissance study were based on the information provided in *Alluvial Valley Floor Identification and Study Guidelines* published by the OSM (1983). Although the concept of an AVF may have a technical meaning to a geologist, in the context of

SMCRA, an AVF is a regulatory term that has been defined in statute and clarified in legislative history, court decisions, regulations, and ongoing administrative decisions (1983). The AVF identification criteria established by SMCRA and outlined by OSM were strictly adhered to in the reconnaissance investigation. These delineation criteria are summarized below.

The SMCRA definition of an AVF is based on agricultural water use and the surficial geologic characteristics of a stream valley. An AVF is defined by SMCRA as follows:

> The unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations and windblown deposits. (30 USC 1234–1328)

Regulations, judicial review, and administrative decisions have expanded and clarified the statutory definition as follows (1983):

- The geologic criteria of an AVF are understood to be
  - a topographic valley with a continuous perennial, intermittent, or ephemeral stream channel running through it; and
  - those surface landforms that are either floodplains or terraces if these landforms are underlain by unconsolidated deposits; and
  - within that valley, those side-slope areas that can reasonably be shown to be underlain by alluvium, and which are adjacent to floodplain or terrace landform areas.
- The water availability criteria are met if
  - water is available by surface-water irrigation or subirrigation and is being or has successfully been used to enhance production of agriculturally useful vegetation; or
  - surface water is available in sufficient quantities to support agricultural activities.

Additionally, stream valleys that do not have any agricultural importance or whose importance is not related to the greater water availability of the valleys are not AVFs (1983). Any areas meeting all the geologic criteria and one of the water availability criteria are considered probable AVFs for the purposes of initial, reconnaissance-level identification (1983).

Based on the reconnaissance-level identification study criteria outlined above, six probable AVF areas were identified (see Map 3.18). The delineations of these six probable AVF areas were determined based on 1) specific water availability criteria for each area, 2) the physical capability and historical extent of flood irrigation of the land in each area, and 3) the presence or absence of floodplain and terrace geomorphic features in each area. Those areas that satisfied the geologic and water availability criteria were delineated as probable AVF areas in the reconnaissance investigation. Areas not meeting both criteria were excluded as probable AVFs. The six areas identified as probable AVFs in the tract are along the Kanab Creek and Sink Valley Wash drainages (see Map 3.18). These areas encompass those lands in Petersen's study area that appear to have the greatest likelihood for being potential AVFs (probable AVFs in OSM parlance). The total acreage of probable AVFs in the study area is approximately 533 acres. Of this, approximately 57 acres of probable AVFs occur in the tract. Approximate floodplain acreages and locations described above are the same as approximate acreages and locations of probable

AVFs described here. See Appendix F for a more detailed description of the investigation conducted and the study results.

3.17 Wildlife: General

The wildlife species addressed in this section consist of animal species that are 1) wildlife species managed by the UDWR; 2) avian species protected under federal acts such as the MBTA, and conservation plans such as Birds of Conservation Concern (BCC) (USFWS 2002) and Partners in Flight (PIF) (Parrish et al. 2002); or 3) common wildlife. Fish and wildlife habitats are generally managed according to the guiding principles outlined in the BLM's *Utah Riparian Management Policy* (IM UT-2005-091 (BLM 2005a), *A Strategy for Future Waterfowl Habitat Management on Public Lands* (BLM 1991), and other species- and species-specific direction, such as the KFO RMP (BLM 2008b). The wildlife analysis area comprises the Alton Coal Tract as defined under each action alternative, and the reasonably foreseeable coal haul transportation route.

Under the *Utah Comprehensive Wildlife Conservation Strategy*, mule deer is a species of particular concern (Tier III) with potential to occur in the wildlife analysis area. According to the strategy, "Tier III includes species that are of conservation concern because they are linked to an at-risk habitat, have suffered marked population declines, or there is little information available regarding the ecology or status of the species" (UDWR 2005).

3.17.1 Regional Overview

Wildlife species with potential to occur on or adjacent to the tract or reasonably foreseeable coal haul transportation route are listed in Table 3.17.1. Common wildlife species with potential to occur on the tract are listed in Tables 3.17.2 and 3.17.3. The tract and reasonably foreseeable coal haul transportation route are in the northwest corner of Kane County, the west edge of Garfield County, and the east half of Iron County. The status and habitats of species were obtained from the BLM, Utah Conservation Data Center (2008), and wildlife surveys conducted by SWCA in 2007 and 2008. Appendix I's reconnaissance survey report lists the wildlife species eliminated from detailed analysis and any reasons the species were not analyzed.

Table 3.17.1. Big Game and Migratory Bird Species with Potential to Occur on the Tract and/or Reasonably Foreseeable Coal Haul Transportation Route

Common Name (*scientific name*)	Status
Big Game Species	
Mule deer (*Odocoileus hemionus*)	UDWR-managed
Pronghorn antelope (*Antilocapra americana*)	UDWR-managed
Rocky Mountain elk (*Cervus canadensis*)	UDWR-managed
Migratory Bird Species	
Bendire's Thrasher (*Toxostoma bendirei*)	BCC, PIF
Black-chinned Sparrow (*Spizella atrogularis*)	BCC
Black-throated Gray Warbler (*Setophaga nigrescens*)	BCC, PIF
Brewer's Sparrow (*Spizella breweri*)	BCC, PIF
Broad-tailed Hummingbird (*Selasphorus platycercus*)	PIF
Gambel's Quail (*Callipepla gambelii*)	PIF
Gray Vireo (*Vireo vicinior*)	BCC, PIF
Loggerhead Shrike (*Lanius ludovicianus*)	BCC

Table 3.17.1. Big Game and Migratory Bird Species with Potential to Occur on the Tract and/or Reasonably Foreseeable Coal Haul Transportation Route

Common Name (*scientific name*)	Status
Lucy's Warbler (*Oreothlypis luciae*)	PIF
Mountain Plover (*Charadrius montanus*)	BCC, PIF
Northern Harrier (*Circus cyaneus*)	BCC
Peregrine Falcon (*Falco peregrinus*)	BCC
Pinyon Jay (*Gymnorhinus cyanocephalus*)	BCC
Prairie Falcon (*Falco mexicanus*)	BCC
Red-naped Sapsucker (*Sphyrapicus nuchalis*)	BCC
Sage Sparrow (*Amphispiza belli*)	BCC, PIF
Swainson's Hawk (*Buteo swainsoni*)	BCC
Virginia's Warbler (*Oreothlypis virginiae*)	BCC, PIF

BCC = birds of conservation concern (2002).

PIF = Utah Partners in Flight priority species (Parrish et al. 2002).

Vegetation on the tract is primarily pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated; where pinyon pine and Utah juniper cover has been mostly removed by vegetation treatments in response to juniper encroachment) (see Map 3.15). Table 3.17.2 shows land cover acreages and associated wildlife species for the tract. These vegetation communities are based on a survey of the tract conducted in fall 2007 (SWCA 2007b). As indicated in Table 3.17.2, there is considerable overlap in the habitat associations of the species addressed in this section. See the Vegetation section of Chapter 3 for a detailed description of the vegetation communities presented in Table 3.17.2.

The sagebrush/grassland (treated) cover type and the sagebrush/grassland cover type differ in that 1) sagebrush/grassland contains an occasional Utah juniper or pinyon pine, and 2) understory species composition and grass/forb cover may be reduced in sagebrush/grassland (treated) due to the presence of chipped tree remnants. However, any reduction in value for wildlife species following treatment would be temporary, and some wildlife species would use these disturbed areas in the interim due to the more open landscape and production of understory species. The vegetation treatment projects that created the sagebrush/grassland (treated) vegetation community are discussed in more detail in Section 3.18.3.4.2.

Table 3.17.2. Vegetation Community Acreages in the Alton Coal Tract and Associated Wildlife Species

Vegetation Community	Associated Wildlife Species	Acres	Percentage of Tract
Pinyon-juniper woodland	Elk, Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter cooperii*), Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler, Black-capped Chickadee (*Poecile atricapillus*), Townsend's Solitaire (*Myadestes townsendii*), Pinyon Jay, Red-naped Sapsucker	1,430.0	40.0%
Sagebrush/grassland	Elk, mule deer, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird (*Sialia currucoides*), Green-tailed Towhee (*Pipilo chlorurus*), Sage Thrasher (*Oreoscoptes montanus*)	860.2	24.1%
Sagebrush/grassland (treated)	Elk, mule deer, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	749.1	20.9%

Table 3.17.2. Vegetation Community Acreages in the Alton Coal Tract and Associated Wildlife Species

Vegetation Community	Associated Wildlife Species	Acres	Percentage of Tract
Annual and perennial grasses	Elk, mule deer, Peregrine Falcon, Prairie Falcon, Swainson's Hawk, Rough-legged Hawk (*Buteo lagopus*) (winter), Mountain Bluebird, Bendire's Thrasher	324.1	9.1%
Mountain brush	Elk, Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler, Spotted Towhee (*Pipilo maculatus*), Gambel's Quail, Black-chinned Sparrow	62.8	1.8%
Meadow (wetland)	Elk, mule deer, Lesser Goldfinch (*Spinus psaltria*), Red-winged Blackbird (*Agelaius phoeniceus*)	62.8	1.8%
Riparian	Elk, Northern Harrier, Red-tailed Hawk (*Buteo jamaicensis*), Great-horned Owl (*Bubo virginianus*), Western Screech-Owl (*Megascops kennicottii*), Downy Woodpecker (*Picoides pubescens*), American Dipper (*Cinclus mexicanus*), Yellow-breasted Chat (*Icteria virens*), Yellow Warbler (*Setophaga petechial*)	55.3	1.5%
Rabbitbrush	Elk, Gambel's Quail, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	10.7	0.3%
Bedrock, cliff, and canyon	Peregrine Falcon, Prairie Falcon, Rock Wren (*Salpinctes obsoletus*)	0.0	0.0%
Open water	Mallard (*Anas platyrhynchos*), shorebirds, fish, amphibians	4.1	< 0.1%
Roads	None	17.4	0.5%
Total		**3,576.5**	**100.0%**

Land cover types described for the tract and reasonably foreseeable coal haul transportation route differ for several reasons: 1) land cover classification was based on detailed vegetation community surveys for the tract, 2) land cover classification was based on SWReGAP coverage for the coal haul transportation route, and 3) land cover types are not identical between the tract and coal haul transportation route. Vegetation community surveys were not conducted along the coal haul transportation route because SWReGAP analysis was deemed to be sufficient for assessment and quantification of habitat areas. Land cover adjacent to the 115-mile reasonably foreseeable coal haul transportation route is primarily sagebrush habitats (39.0%) and developed areas (38.7%). Table 3.17.3 shows land cover miles and associated wildlife species for the coal haul transportation route.

Table 3.17.3. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Wildlife Species

Cover Type	Associated Wildlife Species	Miles	Percentage of Route
Agriculture	Elk, mule deer, pronghorn antelope, Peregrine Falcon, Prairie Falcon, Swainson's Hawk, Say's Phoebe (*Sayornis saya*), Western Kingbird (*Tyrannus verticalis*)	7.3	6.4%
Bedrock, cliff, and canyon	Peregrine Falcon, Prairie Falcon, Rock Wren	1.1	1.0%
Developed*	American Kestrel (*Falco sparverius*), Western Kingbird, American Robin (*Turdus migratorius*), Brown-headed Cowbird (*Molothrus ater*), Brewer's Blackbird	41.6	36.3%
Grassland (native and invasive grasses/forbs)	Elk, mule deer, pronghorn antelope, Rough-legged Hawk (Winter), Mountain Bluebird, Bendire's Thrasher	0.2	0.2%
Open water	Mallard, shorebirds, fish, amphibians	< 0.1	< 0.1%

Table 3.17.3. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Wildlife Species

Cover Type	Associated Wildlife Species	Miles	Percentage of Route
Pinyon-juniper woodland	Elk, Sharp-shinned Hawk, Cooper's Hawk, Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler, Townsend's Solitaire, Pinyon Jay, Red-naped Sapsucker	11.7	10.2%
Riparian	Red-tailed Hawk, Great-horned Owl, Western Screech-Owl, Broad-tailed Hummingbird, Gambel's Quail, Lucy's Warbler, Peregrine Falcon, Downy Woodpecker, American Dipper, Yellow-breasted Chat, Yellow Warbler	0.8	0.7%
Sagebrush	Elk, mule deer, pronghorn antelope, Brewer's Sparrow, Sage Sparrow, Green-tailed Towhee, Sage Thrasher	49.4	43.1%
Salt desert scrub	Pronghorn antelope, Bendire's Thrasher, Black-chinned Sparrow, Brewer's Sparrow, Gambel's Quail, Loggerhead Shrike, Lucy's Warbler, Mountain Plover, Northern Harrier, Prairie Falcon, Sage Sparrow, Black-throated Sparrow, Gambel's Quail	< 0.1	< 0.1%
Shrub-steppe	Elk, mule deer, pronghorn antelope, Brewer's Sparrow, Sage Sparrow, Green-tailed Towhee, Sage Thrasher	0.2	0.2%
Woodland-shrubland	Elk, Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler, Ash-throated Flycatcher (*Myiarchus cinerascens*), Black-capped Chickadee, Spotted Towhee, Black-chinned Sparrow	2.2	1.9%
Total		**114.7**	**100.0%**

* Developed land cover is composed of open space and low-intensity development (i.e., human-modified land cover such as lawns and parks), and medium-to-high-intensity development (i.e., roads, other paved surfaces, and structures).

3.17.2 Wildlife Occurring on the Tract and Coal Haul Transportation Route Analysis Areas

Crucial summer and substantial value summer habitats for mule deer, and crucial summer and year-long substantial habitats for Rocky Mountain elk are present on the tract and/or reasonably foreseeable coal haul transportation route. Crucial winter and crucial year-long pronghorn antelope habitats occur along the coal haul transportation route. Suitable habitat for fish, amphibians, raptors, other resident birds, neotropical migratory birds, and insects is also present on or adjacent to the tract and coal haul transportation route. The tract is within UDWR's Paunsaugunt Primary Management Area. The area encompasses approximately 894,000 acres and is managed as a trophy-hunting unit.

3.17.2.1 BIG GAME

UDWR manages big game species and delineates habitat by season and value for each species. BLM has adopted UDWR's designations and manages the habitat accordingly (BLM 2008b). The habitat values are defined as follows:

- Crucial Value: Any particular range or habitat component that directly limits a community, population, or subpopulation to reproduce and maintain itself at a certain level over the long term
- High-Value: Any particular habitat that sustains a community, population, or subpopulation
- Substantial Value: Any particular habitat that is common or of intermediate importance

3.17.2.1.1 Mule Deer

Mule deer are widespread in Utah, but are present in the greatest densities in shrublands on rough, broken terrain with abundant browse and cover. Deer migrate into the same areas every winter, regardless of forage availability or condition. Winter range habitat consists primarily of shrub-covered, south-facing slopes and often coincides with areas of concentrated human use and occupation (BLM 2008b). Sagebrush serves as primary forage for mule deer during the winter season. Mule deer summer range habitat types include spruce/fir, aspen, alpine meadows, and large grassy parks at higher elevations.

Crucial and high-value mule deer habitats exist in the west portions of Kane County and throughout Garfield County (BLM 2008b). UDWR manages mule deer in the Alton area as a part of the Paunsaugunt herd management unit (HMU) (#27). This management unit consists of 312,882 acres of summer habitat, 105,443 acres of crucial summer habitat, and 207,439 acres of substantial value summer habitat. The management unit also contains 608,996 acres of winter habitat, 156,971 acres of crucial winter habitat, and 452,025 acres of substantial value winter habitat (UDWR 2006). There are 108.9 acres of crucial mule deer summer habitat on the tract (0.1% of crucial summer habitat in the HMU) and 2,005 acres of substantial value summer habitat (1.0% of substantial value summer habitat in the HMU) (Map 3.20). The reasonably foreseeable coal haul transportation route crosses 21.2 miles of crucial winter habitat (18.4% of the route), 18.6 miles of crucial summer habitat (16.2% of the route), 11.7 miles of year-long substantial value habitat (10.2% of the route), 8.6 miles of substantial value summer habitat (7.5% of the route), and 10.2 miles of substantial value winter habitat (8.9% of the route).

3.17.2.1.2 Elk

The Rocky Mountain elk is a habitat generalist that inhabits grasslands, woodlands, riparian, shrub, sagebrush, and pinyon-juniper habitats (2008). UDWR manages elk in the Alton area as a part of the Paunsaugunt HMU (#27). This management unit consists of 957,122 acres of habitat, including 83,854 acres of substantial summer, 175,970 acres of year-long substantial, and 17,489 acres of crucial winter habitat (UDWR 2012). There are 3,505.5 acres of substantial summer habitat (4.2% of the habitat in the management unit) (see Map 3.20) and 71.1 acres of year-long substantial value habitat on the tract (less than 0.1% of the habitat on the management unit). The reasonably foreseeable coal haul transportation route crosses 15.8 miles of substantial value winter habitat (13.7% of the route) and 10.4 miles of substantial value summer habitat (9.0% of the route).

3.17.2.1.3 Pronghorn Antelope

In Utah, pronghorn antelope prefer desert, grassland, and sagebrush habitats (2008). Suitable pronghorn habitats exist on the sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses of the tract, which totals 1,933 acres (54.0% of the tract). However, there are no UDWR-designated pronghorn habitat areas on the tract. The reasonably foreseeable coal haul transportation route crosses 54.0 miles of crucial year-long habitat (47.0% of the route) and 5.9 miles of crucial winter habitat (5.1% of the route).

3.17.2.2 RAPTORS

Habitat needs for raptors include nesting sites, foraging areas, and roosting or resting sites. Roosting generally occurs in riparian areas and on cliff faces. Potential nesting and roosting sites occur primarily in riparian habitats on approximately 55 acres (2%) of the tract, and in cliff and canyon habitats along approximately 1 mile (1%) of the reasonably foreseeable coal haul transportation route. Cliff and canyon habitat does not occur on the tract. Stream and riparian habitats occur on approximately 38 acres within

100 feet of the coal haul transportation route (the maximum likely distance that coal could be transported from the route). Habitat loss and disturbance to nest sites, reduction of the prey base, electrocution from power lines, and environmental contaminants are the primary threats to raptor species (Parrish et al. 2002). Common raptor species with potential to occur on the tract include Northern Harrier, Cooper's Hawk, Sharp-shinned Hawk, Red-tailed Hawk, Swainson's Hawk, Rough-legged Hawk (winter only), American Kestrel, Prairie Falcon, Peregrine Falcon, Great-horned Owl, and Western Screech-Owl.

3.17.2.3 MIGRATORY BIRDS

Migratory birds require nesting and brooding habitat, nonbreeding foraging and resting habitat, habitat along migratory routes, and wintering habitat. Neotropical migratory bird populations are in decline due to habitat fragmentation, habitat loss and modification, urban expansion, loss of nonbreeding habitats and habitats along migratory routes, and brood parasitism (Parrish et al. 2002).

In addition to the BCC and PIF species listed in Table 3.17.1, other common migratory bird species have the potential to occur on the tract or reasonably foreseeable coal haul transportation route. These species are listed in Tables 3.17.2 and 3.17.3. As indicated in Parrish et al. (2002), riparian, wetland, agriculture, and desert scrub are particularly important as breeding and wintering migratory bird habitats.

3.17.2.4 AMPHIBIANS

Most amphibian species require water sources or wet soils to complete their life cycles. Common amphibians could occur in the wetland or riparian vegetation communities on the tract. Common amphibians that could occur in the tract include Great Basin spadefoot (*Spea intermontana*), red-spotted toad (*Bufo punctatus*), Woodhouse's toad (*Bufo woodhousii*), Western chorus frog (*Pseudacris triseriata*), and tiger salamander (*Ambystoma tigrinum*).

3.17.2.5 FISH

The flow rates of Kanab Creek and Lower Robinson Creek, which are the two largest streams on the tract, are too variable to support and sustain fish populations. Kanab Creek is categorized in the National Hydrography Dataset as a perennial stream that has flow throughout the year. However, observed flow in Kanab Creek is highly dependent on climate and upstream water use and has been observed to run very low (less than 0.1 cfs) through the tract during the summer (Petersen Hydrologic 2007). Flows in Lower Robinson Creek are usually minimal. In its upper and middle reaches, Robinson Creek is an ephemeral wash with discharge occurring rarely (Petersen Hydrologic 2013).

Perennial rivers and creeks with sustained flows parallel the reasonably foreseeable coal haul transportation route, including the Sevier River, Threemile Creek, and Bear Creek. These water bodies contain fish habitat and populations of trout, including brown (*Salmo trutta*), brook (*Salvelinus fontinalis*), cutthroat (*Oncorhynchus clarkii*), and rainbow (*O. mykiss*). Trout are stocked in the Sevier River.

3.18 Wildlife: Special Status Species

The special status species addressed in this section consist of animal species that are 1) federally listed as threatened, endangered, candidate, proposed, or petitioned; 2) Utah BLM state director's sensitive species; 3) species protected under the Bald and Golden Eagle Protection Act (BGEPA), as amended; or 4) UDWR sensitive species. The federal ESA of 1973 (PL 93-205, as amended) protects federally listed species from actions that may jeopardize their existence. This could occur through direct harm; activities resulting in increased stress during critical life history stages such as nesting, migration, or wintering; loss or degradation of critical habitat; or loss or degradation of occupied or potential habitats. Fish and wildlife habitats are generally managed according to the guiding principles outlined by the BLM's *Utah Riparian Management Policy* (IM UT-2005-091) (BLM 2005a), *A Strategy for Future Waterfowl Habitat Management on Public Lands* (BLM 1991), and other species- and species-specific direction, such as the IM 2012-043 (BLM 2011c) describing Greater Sage-Grouse interim management policies and procedures, and the KFO RMP (BLM 2008b).

The special status species analysis area includes the Alton Coal Tract as defined under each action alternative, and the reasonably foreseeable coal haul transportation route; this analysis area applies to all species except the Greater Sage-Grouse, which is described in detail in Section 3.18.3.4.

The wildlife special status species section is divided into three subsections. The first provides a regional overview of special status animal species with potential to occur on the tract and/or reasonably foreseeable coal haul transportation route (Section 3.18.1). The second describes all special status species with potential to occur on the tract except for Greater Sage-Grouse (Section 3.18.2). The third section (3.18.3) is devoted solely to Greater Sage-Grouse.

3.18.1 Regional Overview

Special status species with potential to occur on or adjacent to the tract or reasonably foreseeable coal haul transportation route are listed in Table 3.18.1. The tract and reasonably foreseeable coal haul transportation route are in the northwest corner of Kane County, the west edge of Garfield County, and the east half of Iron County. The status and habitats of listed species were obtained from the BLM, from the Utah Conservation Data Center (2008), and from wildlife surveys conducted in 2007 and 2008. Appendix I's reconnaissance survey report lists the special status animal species eliminated from detailed analysis and any reasons the species were not analyzed.

Table 3.18.1. Special Status Animal Species with Potential to Occur on the Tract and/or Reasonably Foreseeable Coal Haul Transportation Route

Common Name (*scientific name*)	Status
Federally Listed Species	
California condor (*Gymnogyps californianus*)	Federally endangered
Utah prairie dog (*Cynomys parvidens*)	Federally threatened
Greater Sage-Grouse (*Centrocercus urophasianus*)	Federal candidate species under ESA, BLM sensitive, SPC
Sensitive Species	
Allen's big-eared bat (*Idionycteris phyllotis*)	BLM sensitive, SPC
Arizona toad (*Bufo microscaphus*)	BLM sensitive, SPC

Table 3.18.1. Special Status Animal Species with Potential to Occur on the Tract and/or Reasonably Foreseeable Coal Haul Transportation Route

Common Name (*scientific name*)	**Status**
Bald Eagle (*Haliaeetus leucocephalus*)	SPC, BGEPA
Big free-tailed bat (*Nyctinomops macrotis*)	BLM sensitive, SPC
Black Swift (*Cypseloides niger*)	BLM sensitive, SPC, PIF
Bonneville cutthroat trout (*Oncorhynchus clarki utah*)	BLM sensitive, CS
Burrowing Owl (*Athene cunicularia*)	BLM sensitive, SPC
Desert sucker (*Catostomus clarki*)	SPC
Ferruginous Hawk (*Buteo regalis*)	BLM sensitive, SPC
Fringed myotis (*Myotis thysanodes*)	BLM sensitive, SPC
Golden Eagle (*Aquila chrysaetos*)	BGEPA
Kit fox (*Vulpes macrotis*)	SPC
Leatherside chub (*Gila copei*)	BLM sensitive, SPC
Lewis's Woodpecker (*Melanerpes lewis*)	BLM sensitive, SPC
Long-billed Curlew (*Numenius americanus*)	BLM sensitive, SPC
Northern Goshawk (*Accipiter gentilis*)	BLM sensitive, CS
Pygmy rabbit (*Brachylagus idahoensis*)	BLM sensitive, SPC
Short-eared Owl (*Asio flammeus*)	BLM sensitive, SPC
Spotted bat (*Euderma maculatum*)	BLM sensitive, SPC
Three-toed Woodpecker (*Picoides tridactylus*)	BLM sensitive, SPC
Townsend's big-eared bat (*Corynorhinus townsendii*)	BLM sensitive, SPC
Virgin spinedace (*Lepidomeda mollispinis*)	CS
Western toad (*Bufo boreas*)	SPC

SPC = wildlife species of concern (2008).

CS = Species receiving special management under a conservation agreement to preclude the need for federal listing (2008).

BGEPA = species protected under the Bald And Golden Eagle Protection Act.

PIF = Utah Partners in Flight priority species (Parrish et al. 2002).

Vegetation on the tract is primarily pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated; where pinyon pine and Utah juniper cover has been mostly removed in response to juniper encroachment) (see Map 3.15). Table 3.18.2 shows land cover acreages and associated special status animal species for the tract. These vegetation communities are based on a survey of the tract conducted in fall 2007 (2007b). The vegetation treatment projects that created the sagebrush/grassland (treated) vegetation community are discussed in more detail in Section 3.18.3.4.2. As indicated in Table 3.18.2, there is considerable overlap in the habitat associations of the species addressed in this section. See the Vegetation section of Chapter 3 for a detailed description of the vegetation communities presented in Table 3.18.2.

Table 3.18.2. Vegetation Community Acreages in the Alton Coal Tract and Associated Special Status Animal Species

Vegetation Community	Associated Wildlife and Special Status Animal Species	Acres	Percentage of Tract
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	1,430.0	40.0%
Sagebrush/grassland	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	860.2	24.1%
Sagebrush/grassland (treated)	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	749.1	20.9%
Annual and perennial grasses	Ferruginous Hawk, Long-billed Curlew, Short-eared Owl	324.1	9.1%
Mountain brush	Ferruginous Hawk, Lewis's Woodpecker	62.8	1.8%
Meadow (wetland)	Western toad	62.8	1.8%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, western toad	55.3	1.5%
Rabbitbrush	Burrowing Owl, Ferruginous Hawk, Golden Eagle, Greater Sage-Grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat	10.7	0.3%
Bedrock, cliff, and canyon	Allen's big-eared bat, Black Swift, big free-tailed bat, Golden Eagle, fringed myotis, spotted bat, Townsend's big-eared bat	0.0	0.0%
Open water	Black Swift	4.1	< 0.1%
Roads	None	17.4	0.5%
Total		**3,576.5**	**100.0%**

The sagebrush/grassland (treated) cover type and the sagebrush/grassland cover type differ in that 1) sagebrush/grassland contains an occasional Utah juniper or pinyon pine, and 2) understory species composition and grass/forb cover may be reduced in sagebrush/grassland (treated) due to the presence of chipped tree remnants. However, any reduction in value for wildlife species following treatment would be temporary, and some wildlife species would use these disturbed areas in the interim due to the more open landscape and production of understory species.

Land cover types described for the tract and reasonably foreseeable coal haul transportation route differ for several reasons: 1) land cover was based on detailed vegetation community surveys for the tract, 2) land cover was based on SWReGAP coverage for the reasonably foreseeable coal haul transportation route, and 3) land cover types are not identical between the tract and reasonably foreseeable coal haul transportation route. Vegetation community surveys were not conducted along the reasonably foreseeable coal haul transportation route because SWReGAP analysis was deemed to be sufficient for assessment and quantification of habitat areas. Land cover adjacent to the 115-mile reasonably foreseeable coal haul transportation route is primarily sagebrush habitats (39.0%) and developed areas (38.7%). Table 3.18.3 shows land cover miles and associated special status animal species for the reasonably foreseeable coal haul transportation route.

Table 3.18.3. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Miles	Percentage of Route
Agriculture	Ferruginous Hawk, Long-billed Curlew, Short-eared Owl	7.3	6.4%
Bedrock, cliff, and canyon	Allen's big-eared bat, black swift, big free-tailed bat, fringed myotis, spotted bat, Townsend's big-eared bat, California condor	1.1	1.0%
Developed*	None	41.6	36.3%
Grassland (native and invasive grasses/forbs)	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Long-billed Curlew, Short-eared Owl, Utah prairie dog	0.2	0.2%
Open water	Black Swift, Bonneville cutthroat trout	< 0.1	< 0.1%
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	11.7	10.2%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, Western toad	0.8	0.7%
Sagebrush	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	49.4	43.1%
Salt desert scrub	Big free-tailed bat, Burrowing Owl, Ferruginous Hawk, Golden Eagle, kit fox, long-billed Curlew, Short-eared Owl, spotted bat	< 0.1	< 0.1%
Shrub-steppe	Burrowing Owl, Ferruginous Hawk, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat, Utah prairie dog	0.2	0.2%
Woodland-shrubland	Black Swift, elk, Ferruginous Hawk, Lewis's Woodpecker, Three-toed Woodpecker	2.2	1.9%
Total		**114.7**	**100.0%**

* Developed land cover is composed of open space and low-intensity development (i.e., human-modified land cover such as lawns and parks), and medium-to-high-intensity development (i.e., roads, other paved surfaces, and structures).

3.18.2 Special Status Species (except Greater Sage-Grouse)

3.18.2.1 PYGMY RABBIT

The pygmy rabbit requires dense, tall stands of sagebrush (*Artemisia* spp., especially *A. tridentata*) with sandy or alluvial soils that are conducive to burrowing (Bosworth 2003). Population densities vary in response to habitat quality, but the habitat or environmental factors that cause population fluctuations are poorly understood (Green et al. 1980). The species is believed to have declined from historic levels in response to reduced habitat quality and quantity. Habitat loss and degradation are primarily due to changes in fire regimes, land conversion for development and agriculture, livestock grazing, and weed invasions (Bosworth 2003).

The home range of pygmy rabbits is centered on a grouping of burrows, which they construct themselves and occupy year-round. A study conducted in Idaho by Heady and Laundré (Heady 2005) found that the mean home range sizes of female and male rabbits were 91.9 and 167.8 acres (37.2 and 67.9 hectares), respectively. However, they also found that the rabbits spent a disproportionate amount of time within 60 meters of their burrows. Heady and Laundré also suggest that the pygmy rabbit is possibly limited in distribution and abundance by available burrow sites. Like most burrowing mammals, pygmy rabbits seek protection in burrows when disturbed.

It is unknown whether pygmy rabbits are present on the tract. If they are present, they are likely not abundant or occur in discrete habitat patches. One incidental sighting has been reported on the tract; however, no systematic surveys have been conducted for this species, and it is unknown if any burrow systems are on the tract. Potential habitat for this species occurs in rabbitbrush, sagebrush/grassland, and sagebrush/grassland (treated) habitats on approximately 1,620 acres (45%) of the tract. The species is known to occur on the reasonably foreseeable coal haul transportation route. Forty-seven miles (42%) of the route consist of sagebrush and shrub-steppe habitat. Pygmy rabbits are likely found in a patchy distribution within that habitat type along the route.

3.18.2.2 UTAH PRAIRIE DOG

The Utah prairie dog is endemic to southwest Utah in the southern Bonneville Basin and in central Utah at high elevations (Bosworth 2003). Critical habitat has not been designated for the species. A revised recovery plan was completed for the Utah prairie dog in 2012 (USFWS 2012), and the Utah Prairie Dog Interim Conservation Strategy was completed in 1997 (Utah Prairie Dog Implementation Team 1997). The UDWR initiated a translocation program in 1972 to move Utah prairie dogs from private lands to areas of historical occupancy on public lands. The prairie dog translocation program has become a key element in Utah prairie dog management and recovery, and is authorized by the USFWS under the ESA. The tract and a portion of the reasonably foreseeable coal haul route are in the Paunsaugunt Utah Prairie Dog Recovery Unit. This recovery unit has sustained a population hovering around 1,000 individuals since 1995 (USFWS 2012). The remainder of the reasonably foreseeable coal haul route is on the West Desert Recovery Unit, which sustains a population of approximately 4,000 individuals (USFWS 2012).

Prairie dog habitats consist of continuous grassland and other vegetation on flat plains (BLM 2008b). Succulent vegetation is crucial for Utah prairie dog survival during drought (Crocker-Bedford et al. 1981). Populations have declined dramatically from historic levels to the current total of approximately 7,200 adults (Crowther 2013). The primary threats to the species are direct habitat loss from development and agricultural use and plague (Crowther 2013). Bubonic plague and sylvatic plague can cause dramatic population fluctuations, and poisonings and shootings have affected populations in some areas (Crowther 2013). Populations of Utah prairie dog are not present on the tract or on BLM-managed lands elsewhere in Kane County, but populations are known to exist along the reasonably foreseeable coal haul transportation route. Suitable Utah prairie dog habitat occurs in sagebrush, grassland, and shrub-steppe habitats adjacent to US-89, SR-20, I-15, and SR-56 along approximately 47 miles (43%) of the reasonably foreseeable coal haul transportation route. The USFWS has established a 350-foot buffer as the range within which normal behavior of individual Utah prairie dogs may be disrupted by noise or human presence (Fox 2010). Known Utah prairie dog colonies occur within 350 feet of the reasonably foreseeable coal haul transportation route on 673 acres and are estimated to contain approximately 1,768 prairie dogs, or 24% of the total known Utah prairie dog population (Crowther 2013). Note that it is impossible to know exactly how many prairie dogs would be in the 350-foot buffer at any one time. Some colonies straddle the buffer, and the count reported of individuals within the buffer includes the entire count for all colonies where even a small portion is in the buffer.

3.18.2.3 KIT FOX

The kit fox inhabits the western United States and northern Mexico, but is not widely abundant in Utah (UDWR 2008). The species prefers sparsely vegetated greasewood, shadscale, or sagebrush-dominated habitats (Crowther 2013), and has the potential to occur on the tract and along the reasonably foreseeable coal haul transportation route. The kit fox's specific distribution is not known, but high- and substantial-value habitats exist on or near the west portion of the reasonably foreseeable coal haul transportation route in Iron County (UDWR 2008). Suitable habitats consist of sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush habitats on 1,620 acres (45%) of the tract, and on sagebrush and shrub-steppe habitats along 47 miles (43%) of the reasonably foreseeable coal haul transportation route. Reports of average kit fox home range size are approximately 11 km^2, or 2,718 acres (List et al. 2003; White et al. 1993). Exact home range sizes depend on the regional climate, habitat availability, and prey availability. If this home range size is correct for the habitat of the tract, the tract likely provides part of the home range for one kit fox individual.

3.18.2.4 BAT SPECIES

Five special status bat species have suitable habitats on the tract and reasonably foreseeable coal haul transportation route. These bat species occupy a variety of habitats, but their ecological needs are fundamentally the same and consist of secure roosting sites and insect prey. Reductions in the prey base from pesticide use, disturbance of roost sites, and mine closures are the primary threats to bat species (UDWR 2005). The species addressed here use rocky cliffs, crevices, or outcroppings as roost sites. However, caves or mines in any habitat may be used as a roosting site. Bat roost sites in cliff and canyon habitats do not exist on the tract, but do exist along approximately 1 mile (1%) of the reasonably foreseeable coal haul transportation route. Some bat species are also known to use stream and riparian habitats, which are quantified within 100 feet of the reasonably foreseeable coal haul transportation route based on the maximum likely distance that coal could be transported from the route.

Allen's big-eared bat occurs in Garfield and Kane counties (UDWR 2005). The species prefers riparian areas dominated by cottonwood and willow trees, forested mountain areas, and pinyon-juniper habitats (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, suitable roosting and foraging areas occur in pinyon-juniper woodland and riparian habitats on 1,485 acres (42%) of the tract and along 10 miles (9%) of the reasonably foreseeable coal haul transportation route. There are approximately 38 acres of riparian habitat within 100 feet of the route.

The **big free-tailed bat** inhabits rugged, rocky terrain, and roosts in rock crevices and cliff faces (Foster et al. 1996). The species forages in desert scrub and riparian habitats. In addition to roosting habitat in cliff and canyon habitat types along the reasonably foreseeable coal haul transportation route, foraging habitats exist in riparian habitat on 55 acres (2%) of the tract and in salt desert scrub along 0.1 mile (0.1%) of the route. There are approximately 38 acres of riparian habitat within 100 feet of the route.

The **fringed myotis** is associated with rocky outcroppings, cliffs, and canyons (Crowther 2013), and are known to use sagebrush and grasslands as foraging habitats (Foster et al. 1996). In addition to suitable roosting sites in cliff and canyon habitat, foraging habitats for this species include sagebrush/grassland and sagebrush/grassland (treated) habitats on 1,609 acres (45%) of the tract, and in sagebrush and grassland habitats along 43 miles (39%) of the reasonably foreseeable coal haul transportation route.

The **spotted bat** is associated with deep, narrow, rocky canyons with precipitous cliffs and crevices in cliff walls. The species is known to use open sagebrush or desert scrub as foraging habitat (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, foraging habitats for this species include sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush habitats on 1,620 acres (45%) of the tract, and sagebrush, shrub-steppe, and salt desert scrub along 47 miles (43%) of the reasonably foreseeable coal haul transportation route.

Townsend's big-eared bat occurs in sagebrush steppe, pinyon-juniper, and other habitat types with caves or mines for roost sites (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat (where caves are present), foraging habitat for this species occurs in pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated) habitats on 3,039 acres (85%) of the tract, and in sagebrush, pinyon-juniper woodland, and shrub-steppe along 56 miles (51%) of the reasonably foreseeable coal haul transportation route.

3.18.2.5 RAPTOR SPECIES

Habitat needs for raptors include nesting sites, foraging areas, and roosting or resting sites. Roosting generally occurs in riparian areas and on cliff faces. Potential nesting and roosting sites occur in riparian habitats on approximately 55 acres (2%) of the tract, and in cliff and canyon habitats along approximately 1 mile (1%) of the reasonably foreseeable coal haul transportation route. Cliff and canyon habitat does not occur on the tract. Stream and riparian habitats occur on approximately 38 acres within 100 feet of the reasonably foreseeable coal haul transportation route (the maximum likely distance that coal could be transported from the route). Habitat loss and disturbance to nest sites, reduction of the prey base, electrocution from power lines, and environmental contaminants are the primary threats to raptor species (Parrish et al. 2002). In addition to the six raptor species addressed here, migratory raptor species are discussed in the Migratory Birds section.

The **Bald Eagle** winters in Utah along rivers, streams, lakes, reservoirs, ponds, and sewage lagoons within riparian or sub-montane woodlands (Crowther 2013). There are no active breeding sites in Garfield, Kane, or Iron counties (Crowther 2013). Riparian areas on the tract and reasonably foreseeable coal haul transportation route, quantified above, could provide wintering habitat for this species.

The **Burrowing Owl** prefers sagebrush steppe, desert scrub, and other shrub-dominated habitats with abandoned animal burrows for nesting sites (Crowther 2013). Suitable nesting and foraging habitats in sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush occur on 1,620 acres (45%) of the tract, and in sagebrush, shrub-steppe, grassland, and salt desert scrub habitats along 47 miles (43%) of the reasonably foreseeable coal haul transportation route.

The **California Condor** has experienced an extremely reduced distribution and dramatic decline in abundance since European settlement (USFWS 2013b). The current distribution occurs only in California and Mexico, with an experimental population centered on the Vermillion Cliffs of northern Arizona. This species is very wide-ranging and may travel 50–100 miles in a single day. It requires great expanses of foraging habitat because it depends on widely spaced sources of carrion for food. Individuals from the northern Arizona experimental population have been observed in southern Utah flying through areas such as Bryce Canyon National Park. There are no recorded observations of this species on the tract, but it could occasionally fly through the area in search of carcasses. It may also search for road kill carcasses along the reasonably foreseeable coal haul transportation route.

The **Ferruginous Hawk** forages in grasslands, agricultural lands, mixed shrub habitats, and on the periphery of pinyon-juniper forests. Breeding occurs in pinyon-juniper and juniper shrub habitat assemblages and sagebrush steppe (Walters et al. 1983). Suitable nesting and foraging habitats occur in pinyon-juniper woodland, sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses, mountain brush and rabbitbrush on 3,437 acres (96%) of the tract, and in pinyon-juniper woodland, sagebrush, agriculture, shrub-steppe, woodland-shrubland, grassland and salt desert scrub along 66 miles (60%) of the reasonably foreseeable coal haul transportation route.

The **Golden Eagle** nests in cliff habitats and forages in high desert scrub (Parrish et al. 2002). Suitable foraging habitats in sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush occur on 1,620 acres (45%) of the tract, and in sagebrush, shrub-steppe, and salt desert scrub along 47 miles (43%) of the reasonably foreseeable coal haul transportation route.

The **Northern Goshawk** prefers mountain forest and riparian habitats and is a year-round resident of Utah (UDWR 2008). Winter foraging and roosting habitats occur in pinyon-juniper woodlands on 1,430 acres (40%) of the tract. Potential nesting habitats are limited to riparian habitats on 55 acres (2%) of the tract, and 38 acres within 100 feet of the reasonably foreseeable coal haul transportation route.

The **Short-eared Owl** is a ground-nesting species that inhabits arid grasslands, croplands, cold desert shrub, and sagebrush-rabbitbrush habitats (Crowther 2013). The species may migrate or remain as a year-round resident in Utah (UDWR 2008). Suitable foraging and nesting habitats in sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses, and rabbitbrush occur on 1,944 acres (54%) of the tract, and in sagebrush, agriculture, shrub-steppe, grassland, and salt desert scrub along 54 miles (49%) of the reasonably foreseeable coal haul transportation route.

3.18.2.6 MIGRATORY BIRD SPECIES

Migratory birds require nesting and brooding habitat, nonbreeding foraging and resting habitat, habitat along migratory routes, and wintering habitat. Neotropical migratory bird populations are in decline due to habitat fragmentation, habitat loss and modification, urban expansion, loss of nonbreeding habitats and habitats along migratory routes, and brood parasitism (Parrish et al. 2002). Four special status migratory bird species have potential to occur in the tract and reasonably foreseeable coal haul route.

The **Black Swift** is very rare in Utah with no confirmed nesting sites in Garfield, Kane, or Iron counties (Crowther 2013; Parrish et al. 2002). The species only nests near or behind waterfalls, and no potential breeding sites are known to exist on the tract or within 100 feet of the reasonably foreseeable coal haul transportation route. The species is migratory, arriving in Utah in late May or early June and remaining as late as October (Parrish et al. 2002). The Black Swift feeds exclusively on flying insects, and may forage over rivers and streams up to 25 miles from nesting colonies (Parrish et al. 2002). Loss of nesting habitat due to reduction or loss of water flow, reduced prey base due to pesticide use, and direct disturbance to nesting sites are the primary causes of reduced distribution and declining populations (Parrish et al. 2002). Foraging habitat may occur in association with riparian areas on 55 acres (2%) of the tract and on 38 acres of the reasonably foreseeable coal haul transportation route.

Lewis's Woodpecker is a cavity nesting species that breeds in ponderosa pine (*Pinus ponderosa*) habitats, but may also use riparian cottonwoods or montane shrub habitats (Parrish et al. 2002). The species eats insects during breeding season, and nuts and berries in fall and winter (Ehrlich et al. 1988). Lewis's Woodpecker inhabits open habitats with widely spaced trees and an understory of grasses and shrubs to provide insect prey and plant forage (Parrish et al. 2002). Loss of habitat due to tree removal and changes in forest structure as well as grazing by livestock are the primary threats to the species (Parrish et al. 2002). Secondary breeding habitat may occur in pinyon-juniper woodland, riparian, and mountain brush habitats on 1,548 acres (43%) of the tract, and in pinyon-juniper woodland and woodland-shrubland habitats along 12 miles (11%) of the reasonably foreseeable coal haul transportation route. In addition, there are approximately 38 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route.

The **Long-billed Curlew** is a migrant and summer resident in Utah that requires short grass and bare-ground breeding habitats with shade and abundant small vertebrate prey (Pampush 1980; Parrish et al. 2002). Uncultivated rangelands and pastures support most of the breeding population in Utah. Loss and modification of breeding habitats and predation by foxes and domestic pets are the primary threats to the species and have caused dramatic population declines. Breeding habitats include pasture, meadow, and sagebrush/grassland. Suitable breeding habitats include sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses on 1,933 acres (54%) of the tract, and in agriculture, shrub-steppe, grassland, and salt desert scrub habitats along 11 miles (10%) of the reasonably foreseeable coal haul transportation route.

The **Three-toed Woodpecker** is a cavity nesting species that breeds and winters in high-elevation coniferous forests in Utah (Parrish et al. 2002). The species requires coniferous trees (living and dead) to support its prey of wood-boring insect larvae, but may also use mixed forest habitats (Hill et al. 2001). Populations fluctuate in response to bark beetle outbreaks. Tree removal and fire suppression that remove standing dead trees are the primary threat to the species (Parrish et al. 2002). Suitable breeding and foraging habitats are limited to woodland-shrubland habitats along approximately 2 miles (2%) of the reasonably foreseeable coal haul transportation route. No suitable coniferous forest habitat occurs on the tract.

3.18.2.7 AMPHIBIAN SPECIES

The **Arizona toad** is present in Kane County with most of its Utah distribution concentrated to the west in the Virgin River basin in Washington County (UDWR 2005). In Utah, this species inhabits juniper-dominated habitats and low-elevation riparian habitats near permanent or semipermanent water bodies (Crowther 2013). The Arizona toad lays eggs on the bottoms of shallow, slow-moving streams. Threats to this species include loss of native vegetation and riparian corridors (UDWR 2005) as well as water withdrawals (Crowther 2013). Suitable habitats in pinyon-juniper habitats near water bodies and riparian habitats occur on a maximum of 1,430 acres (40%) of the tract. In addition, there are approximately 38 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route.

The **western toad** inhabits montane areas in riparian, shrub, mixed conifer, and aspen-conifer habitats associated with permanent bodies of water, and breeds in small bodies of water and along creeks and rivers (Crowther 2013). Suitable western toad habitat in meadow wetlands and riparian habitat occurs on 118 acres (3%) of the tract. In addition, there are approximately 38 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route.

3.18.2.8 FISH SPECIES

The **Bonneville cutthroat trout** inhabits major rivers and lakes in parts of Utah, Idaho, Nevada, and Wyoming. Like most trout species, it is found in relatively cool and clean habitats that provide complexity in terms of depth, velocity, and substrate (Lentsch et al. 2000). It is known to occur in the Sevier River watershed, including Threemile Creek in Garfield County, a creek that would be intersected by the reasonably foreseeable coal haul transportation route.

No special status fish species are known to occur on the tract.

3.18.3 Greater Sage-Grouse

The analysis area for Greater Sage-Grouse is defined as the 607,210-acre area presented in Map 3.21. This area also defines the approximate limits of the Panguitch sage-grouse population, and the Panguitch Management Area in the *Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report* (USFWS 2013a). The tract is in the south portion of the analysis area. A subset of the Panguitch population breeds near the tract, as described in detail below.

Areas occupied by the Greater Sage-Grouse are defined by seasonal usage and are mapped by UDWR. According to management action SSS-53 of the KFO RMP, the BLM manages habitat according to UDWR's habitat layer. Consistent with the BLM Washington Office IM-2012-043, the Greater Sage-Grouse habitat data layer updated in 2012 is presented in this document as the best available information, except where site-specific information is available, as described below.

Site-specific information derived from studies conducted by Dr. Nicki Frey (Utah State University) was used to assess the existing condition and potential impacts for this species. Between 2005 and 2009, Dr. Frey placed radio transmitters on 31 sage-grouse (12 male, 4 female, 15 juvenile) trapped at the Alton–

Sink Valley and Hoyt's Ranch leks to determine 1) home range size and seasonal habitat use (Frey et al. 2013b); 2) habitat use, including use of areas where vegetation treatments were completed (Frey et al. 2013a); 3) the extent of connectivity between lek locations (Frey 2010; Frey et al. 2008); 4) potential predators (Curtis et al. 2007); and 5) the rate of fence line mortality (Curtis et al. 2007). Nesting locations were also observed. However, although some nesting activity was documented, it must be noted that the study contained a very small sample size of female grouse; therefore, it is inappropriate to draw explicit conclusions from the gathered information on habitat use of nesting females. The purpose of the radio transmitters placed on birds trapped near the Hoyt's Ranch lek was to document movement between breeding centers within the population and also to document use of areas that have undergone vegetation treatments, as described below (Frey 2010).

Additionally, annual progress reports written by Dr. Steven Petersen (sage-grouse population and habitat consultant for ACD) were also used to gather information specific to the group of birds using the area—see Petersen (2013b, 2013a) as well as the compilation of Petersen annual sage-grouse reports in Appendix 3-5 of the Coal Hollow permit application package (ACD 2007‑2008). These reports were submitted to DOGM to document the actions taken by ACD to increase available habitat through off-site mitigation, as well as all sage-grouse sightings on and near the Coal Hollow operation.

3.18.3.1 REGULATORY STATUS

Greater Sage-Grouse is listed by USFWS as a candidate species. On March 5, 2010, the service determined that listing the species is warranted but precluded by other listings, as detailed in *Endangered and Threatened Wildlife and Plants; 12-month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered; Proposed Rule* (50 CFR 17, *Federal Register* 75:13910–14014). Additionally, under the *Utah Comprehensive Wildlife Conservation Strategy*, Greater Sage-Grouse is a species of particular concern (Tier II). According to the strategy, "Tier II species include those listed on the Utah Species of Concern List under sole state authority" (UDWR 2005).

Currently, the BLM manages Greater Sage-Grouse and its habitat according to BLM Washington Office IM-2012-043. The intent of this IM is to ensure that interim conservation policies and procedures are implemented when field offices authorize or carry out activities on public land while the BLM develops and decides how to best incorporate long-term conservation measures for Greater Sage-Grouse into applicable land use plans. Under this IM when evaluating proposed leases for solid minerals (e.g., coal), BLM is directed to "cumulatively maintain or enhance Greater Sage-Grouse habitat" through minimization and on- and off-site mitigation measures.

In Utah, sage-grouse populations are currently managed by UDWR under the sage-grouse conservation plan (UDWR 2013). The sage-grouse conservation plan reflects sage-grouse recommendations that were provided to the Governor of Utah by a multi-disciplinary group of stakeholders in early 2012. The BLM is currently evaluating an amendment to multiple land use plans under which the sage-grouse conservation plan is one of the action alternatives under consideration. See Section 1.7.1.1 for a more detailed description of the land use plan amendment process.

3.18.3.2 GENERAL HABITAT NEEDS

The Greater Sage-Grouse is a sagebrush-obligate species that requires contiguous sagebrush-dominated habitats (Connelly et al. 2004). In Utah, nesting sage-grouse have been demonstrated to prefer sagebrush more than 16 inches (40 cm) tall and a 15%–50% canopy cover of tall grasses and other concealing vegetation (Connelly et al. 2004). These conditions are consistent with mature, well-developed sagebrush communities. Rangewide, sage-grouse also forage in riparian, wet meadow, and agricultural habitat types during the spring and summer nesting and brood-rearing season, and they are dependent on mature sagebrush stands for forage and shelter in the winter (Connelly et al. 2004).

Leks are open areas where strutting male grouse congregate to compete for the opportunity to mate with females. Sage-grouse congregate near or on lek locations every spring for breeding. Leks normally occur in the same location each year, with some lek locations persisting for over 85 years (Connelly et al. 2011). They often occur in complexes, with one or more primary leks occurring near other lek locations that support fewer males (Connelly et al. 2011). Some variation, or shifting, of lek locations has been observed. Shifting the lek location may occur for several reasons, including persistent disturbance and/or alternation of vegetative cover (Connelly et al. 2011; Holloron 2005; Walker et al. 2007). It is thought that the most important factor affecting a lek location is the proximity to and configuration and abundance of nesting habitat (Connelly et al. 2011; Connelly et al. 2000) and that males form leks opportunistically at sites in or adjacent to this habitat (Connelly et al. 2000). Lek habitat is not considered limiting to sage-grouse populations (Connelly et al. 2011). The lek location is therefore indicative of the location of high-quality nesting habitat, and may change if the quality of that particular nesting habitat declines. It is thought the most important factors for increasing sage-grouse population growth are nest success, chick survival, and female survival, respectively (Taylor et al. 2012). Therefore, maintaining high-quality nesting and brood-rearing habitat is the most essential component to increase or maintain population abundance.

3.18.3.3 DISTRIBUTION AND THREATS

Greater Sage-Grouse population numbers have declined rangewide, and they now occupy approximately 56% of their historic range. The exact decline in sage-grouse population numbers since pre-settlement times is unclear, because estimates were largely anecdotal before the implementation of systematic surveys in the 1950s (USFS 2013). In Utah, Greater Sage-Grouse are present in scattered populations north and west of the Colorado River (UDWR 2002) on approximately 40% of their historic range (Beck et al. 2003).

Population declines are primarily due to habitat loss, habitat fragmentation, and reduced habitat quality resulting from energy development, urban expansion, conversion of habitats to agriculture, and alteration of habitats by invasive species that reduce habitat quality by reducing herbaceous forage and/or increasing the frequency and intensity of ground fires (Bosworth 2003; UDWR 2002). Sagebrush steppe habitats (which are very important to this species) and associated herbaceous understory have been reduced by improper grazing, invasive plant species, altered fire regimes, conifer encroachment, and oil and gas industry expansion (UDWR 2005). Other threats specific to this species include limited distribution and predation by both native and invasive animal species (Connelly et al. 2004; UDWR 2005). Fences can also pose a threat to sage-grouse as vertical barriers, collision risks, and raptor perches (Curtis et al. 2007).

Conifer woodland encroachment into sagebrush habitats has reduced the quality and quantity of sagebrush stands and contributed to the rangewide decline in sage-grouse abundance (Connelly et al. 2004). Juniper encroachment is especially widespread in the analysis area, and is discussed in more detail below (Connelly et al. 2004). The group breeding in Sink Valley has also experienced relatively high mortality from predation, with a relatively large number of sage-grouse known to have been killed by predators since 2005 (Curtis et al. 2007). Increasing predation by predators (domestic pets, red foxes, raccoons) and ravens is of concern (Frey et al. 2008).

3.18.3.4 ANALYSIS AREA DESCRIPTION

The analysis area for the Greater Sage-Grouse is the 607,210-acre area that is referred to as the Panguitch SGMA (see Map 3.21) in the sage-grouse conservation plan and the Panguitch Management Area in the *Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report* (UDWR 2013, USFWS 2013a). This analysis area was chosen for this species because in addition to including the tract area, it encompasses the approximate extent of habitat used by the Panguitch sage-grouse population, which is managed by UDWR as a single population unit.

The tract occurs in the south portion of the analysis area. The extreme south boundary of the analysis area is also the southern-most distribution of the species rangewide. The tract does not exhibit textbook habitat characteristics, possibly because the tract is near the southernmost edge of the species' distribution. For most animal species, habitat conditions near the edge of a species' distribution are often considered suboptimal when compared to habitat near the core of the distribution. Populations that occupy this "fringe" habitat are also more prone to extirpation from stochastic, or unpredictable, events (Doherty et al. 2003); however, these populations may also exhibit important adaptations to suboptimal habitat.

Furthermore, the quality of the sagebrush habitats in the analysis area has declined due to conifer encroachment as well as an increase in dense stands of sagebrush that has occurred regionally since European settlement. Long-term fire suppression efforts, coupled with excessive historical browsing and grazing by wildlife and livestock, have led to the conversion of sagebrush steppe communities into dense shrubland areas and juniper woodlands (BLM 2010c) (Map 3.22), neither of which provides high-quality habitat for sage-grouse. It is evident that the sagebrush habitat has experienced extensive conifer encroachment because vast expanses of the analysis area consist of conifer woodlands with an intact sagebrush understory. Classic conifer encroachment occurs in a contained zone or band where sagebrush and conifer woodland vegetation types abut, but the encroachment in the analysis area has occurred uniformly throughout very large patches.

3.18.3.4.1 Connectivity and Movement between Leks

The Panguitch sage-grouse population is distributed throughout the analysis area. Grouse from this population primarily use the available patches of suitable sagebrush habitat as well as suboptimal agricultural and juniper habitat patches. In the analysis area, connectivity between sagebrush habitat patches has become increasingly blocked by juniper encroachment (Petersen 2006). For the population, it is important to retain connectivity between habitat patches to ensure genetic flow and maintain the fitness of individual breeding groups. It is thought that historical levels of connectivity within the population may have been significantly altered by juniper encroachment, and are likely a factor in the observed decline in use of the Alton–Sink Valley lek (described below).

Observations indicate that although the Sink-Valley group may remain in the Alton–Sink Valley area year-round (described further below), there is dispersion and movement of grouse into and through Sink Valley. Movement of birds has been documented from the Hoyts Ranch lek (north of Alton) to areas south of the tract in the summer, fall and winter (Curtis et al. 2007; Frey 2010). Additionally, evidence of grouse winter use (including observations of large groupings of grouse) has been observed approximately 8 miles southeast of the tract in Ford's Pasture (Petersen 2013a), indicating that birds pass through Sink Valley to get to more southerly wintering habitats. Lastly, two juveniles captured in Sink Valley moved north of Hoyt's Ranch during the winter, and returned to the Sink Valley the following summer (Curtis et al. 2007). Because birds have been documented moving between Sage Hen Hollow, near the town of Panguitch, to Hoyt's Ranch, there is potential for the normal movement patterns of this population to range a linear distance of almost 35 miles, from Sage Hen Hollow in the north to Ford's Pasture in the south (Frey 2009); however, this link has not been directly observed and may currently be altered due to movement corridors blocked by conifer encroachment.

3.18.3.4.2 Completed Analysis Area Vegetation Treatments

As an ongoing objective to improve the habitat of the analysis area for sage-grouse, the BLM and ACD completed a combined 28,296 acres of vegetation treatments in the analysis area between 2009 and 2013, including 1,076.9 acres of treatments within the tract (Maps 3.23 and 3.24). Vegetation treatment locations were chosen to increase habitat availability for the Panguitch population of sage-grouse, as well as to increase connectivity between existing habitat patches. Most vegetation treatments consisted of juniper removal in areas experiencing conifer encroachment of intact sagebrush understories, and subsequent seeding of forbs and grasses. The juniper removal was accomplished mechanically (i.e., with a brush-hog) and by hand-thinning. Cut trees were mulched, and the mulch was spread on the ground as cover for seed. Immediately after tree removal, the treatment area was reseeded with a mixture of forbs and grasses standard for southern Utah. Vegetation treatments typically cost between $79 and $396 per acre. Due to the unique vegetative conditions of the area (i.e., vast areas of juniper encroachment with an intact sagebrush understory), the juniper removal was accomplished while still maintaining the sagebrush understory and leaving much of the shrub community intact. After treatment, the shrub and forb canopy cover increased with the absence of competition from the juniper and filled in the areas where the trees had previously been (Frey et al. 2013a).

Since mining began in 2010, ACD has completed vegetation treatment projects, consisting of juniper removal as described above, to maintain compliance with the Coal Hollow mining permit. These treatments, especially the 808 acres treated on private lands in 2009–2011 (referred to as the Heaton Property) were designed with the intent to increase connectivity for sage-grouse between the Alton–Sink Valley lek and Hoyt's Ranch to the north.

Vegetation treatments consisting of juniper removal from areas with an intact sagebrush understory, like those described above, are generally thought to provide a timely and effective increase of available habitat for local sage-grouse (Baruch-Mordo et al. 2013; Commons et al. 1999). This is especially true for areas immediately adjacent to habitat already occupied by sage-grouse. The Alton–Sink Valley is unique in that there are large expanses of habitat that fit this description; juniper encroachment into sagebrush habitat is evident in uniform patches throughout the analysis area. Potential locations for additional juniper removal treatments in the analysis area are abundant. In fact, BLM has completed NEPA analyses on 172,927 acres of juniper-encroached habitat in the analysis area in the *Upper Kanab Creek Watershed Vegetation Management Project Environmental Assessment* (BLM 2010d) and the *South Canyon Vegetation Enhancement Environmental Assessment* (BLM 2010c) (see Map 3.23) to treat the existing conifer encroachment and improve habitat for wildlife species that use sagebrush habitat, such as the Greater Sage-Grouse. By comparison, a small percentage of lands approved for vegetation treatments have been completed. As funding becomes available, BLM plans to continue to conduct vegetation treatments in the analysis area to accomplish the objective of stabilizing the local population decline by providing additional habitat and increasing connectivity throughout the population.

Many of the juniper removal treatments completed in the analysis area were studied for post-treatment use by sage-grouse. All of the studied areas were used within a year of project completion (Frey et al. 2013a; Frey 2010; Frey 2008). The treatments on the tract resulted in increased sagebrush, forb, and grass cover and increased use of treated areas by sage-grouse in the summer and fall (Frey et al. 2013a). Immediately after the treatment was completed in fall 2005, birds were documented using the treated area, even though there was little vegetation growing (Frey et al. 2013a). The preference for the treated area was most pronounced during fall of the first year, and may be explained by an increased availability of invertebrates as a food source (Frey et al. 2013a). Sage-grouse also demonstrated a strong preference for treated habitat during the brood-rearing season immediately after treatment, suggesting that sufficient brood-rearing habitat had previously been unavailable. For the subsequent four years of telemetry observations, grouse shifted preferential habitat use away from suboptimal agriculture and pinyon-juniper habitat and toward treated sagebrush habitat. This quick response might have been due to the sudden availability of habitat in areas where suitable sagebrush habitat is limited for the sage-grouse (Frey et al. 2013a).

The Heaton Property vegetation treatment was also used by sage-grouse within the year after project completion while grouse were moving south toward winter habitat (Frey 2010). The purpose of this vegetation treatment project was to increase connectivity between Hoyt's Ranch and Sink Valley, and the observed use by sage-grouse suggests it may have indeed increased the connectivity.

Lastly, male breeding behavior (strutting) was observed off the traditional lek and in one of the treated areas of the tract in 2013 (Petersen 2013b; Schaible 2013b). This is described in more detail below.

3.18.3.4.3 Coal Hollow Mining Operation

ACD has conducted mining activities on private lands adjacent to the tract (i.e., the Coal Hollow Mine) since fall 2010. As a condition of the mining permit, sage-grouse have been counted and monitored (both systematically and opportunistically) since 2005 to detect changes in the amount of birds in the area as well as document habitat use. In addition, to fulfill permit obligations, ACD has improved sage-grouse habitat through juniper removal vegetation treatments (as described above). Mining on the Coal Hollow parcel has provided an opportunity to observe how the Panguitch population is affected by the types of activities described in the Proposed Action.

During both systematic and opportunistic surveys before and after mining began, sage-grouse were most often observed in the “Sagebrush Flat” area, an area including parts of Block S of the tract (Petersen 2013b). Flocks of grouse were flushed and otherwise in this area year-round, with flock size increasing to above 61 in fall and winter (Petersen 2013b). Breeding behavior was also observed in this area starting in 2009 (before mining began) and has continued through 2013. It is thought that most birds breeding in the area have nests in the Sagebrush Flat (including Block S); however, nesting has rarely been directly observed (Petersen 2013b).

Despite the research results from oil and gas development in Wyoming (i.e., Holloran 2005), mining at Coal Hollow, in the short term, has not resulted in a reduction of breeding grouse; the number of sage-grouse using the Alton–Sink Valley area was in decline before mining began (described below), but has appeared to remain relatively stable, albeit at low numbers, throughout mining activities (see Table 3.18.4) (Petersen 2013b). The absence of a decline could be for three reasons: 1) to date, ACD has not yet mined all the sagebrush habitat within its current permit boundary, including that adjacent to the federal Block S and the traditional Alton–Sink Valley lek location (described below); 2) the vegetation treatments completed by BLM and ACD have provided additional habitat for sage-grouse (as described above), which has helped stabilize the population decline; and 3) a time-lag effect of impacts has not yet been realized (Harju et al. 2010), meaning that impacts may become evident in the future. Sage-grouse observations and behavior monitoring suggest that mining has had little impact on local sage-grouse behavior (Petersen 2013b). Sage-grouse have been observed in and around the actively mined areas of Coal Hollow, including strutting on the spoils piles as well as drinking from water pooled in surface mining areas. They have also been observed flying over the active mining operations, and are thought to display a tolerance for the mining equipment because they have not been displaced from the area of active mining and do not flush when equipment approaches (Petersen 2013b).

Mining has been completed in one area of the Coal Hollow parcel, which is currently undergoing reclamation activities. During the first year post-reclamation, it exhibited high plant growth and plant cover from triticale (a short-lived grass often used for reclamation). During the second year, some forbs became established. Due to the locally wetter climate of the Alton area and the fact that the sagebrush species planted on the site are black sagebrush and mountain big sagebrush, it is likely that the reclaimed site could provide quality nesting and brood-rearing habitat within 15–20 years (Petersen 2013b).

3.18.3.5 SAGE-GROUSE USE OF THE TRACT

The following section describes the ways in which sage-grouse have been observed and are thought to currently use the habitat provided by the tract. First, observations of the Alton–Sink Valley lek are provided. Next, the results of UDWR’s annual counts are reported, which provide an estimate for the amount of grouse using the tract. Last, seasonal habitat use of the tract is described in detail.

3.18.3.5.1 Lek Description

The traditional Alton–Sink Valley lek is on the private lands of the Coal Hollow mining permit area (east of the tract), and is approximately 0.7 mile from active mining activities. The location of the traditional lek has not been directly altered by mining activities. Since 2008, males were observed displaying breeding behavior on other nearby locations in addition to the traditional location (Petersen 2013a; Schaible 2013b). Most recently, lekking behavior was observed on the spoils piles of the Coal Hollow parcel in 2012 and on BLM-managed lands (Block S of the tract) in 2012 and 2013 (Schaible 2013b). Three to four males were displaying at the time of each observation off the traditional lek location. During recent surveys, most males have been observed displaying consistently on the tract lek location (Schaible 2013b). The Alton–Sink Valley lek is now considered to be a complex of lekking locations, with one centroid located on the tract and another on the traditional lek location (Map 3.26; lek locations are masked due to sensitivity). These leks are hereafter referred to as the traditional Alton Sink-Valley lek (located on private land), and the new Alton–Sink Valley lek (located on federal land) and collectively as the Alton–Sink Valley lek complex. The new lek location occurs in one of the “limited-touch” areas of Block S. The term *limited-touch area* describes areas of intact sagebrush stands outside the area where coal occurs. Surface-disturbing activities in limited-touch areas would be avoided completely for mining activities, and would be avoided if possible for the routing of roads and location of dispersed facilities.

The Alton–Sink Valley sage-grouse lek complex includes the southernmost active Greater Sage-Grouse lek in North America (Curtis et al. 2007; BLM 2008b). There are two abandoned leks south of the Alton–Sink Valley lek at Skutumpah and Ford Pasture. These leks have been inactive since 1994 and 1982, respectively, and may represent the southern limit of the species’ range, because birds continue to use the areas in the winter (Schaible 2013b). The closest active lek to the Alton–Sink Valley lek is the Hoyt’s Ranch lek, approximately 6 miles north of Alton. In 2013, the maximum male count on that lek was 11, implying that approximately 33 sage-grouse were using the area for breeding (Schaible 2013b). Additional active leks with consistently high levels of grouse attendance are in the north portion of the analysis area (e.g., Sage Hen Hollow and Dog Valley).

3.18.3.5.2 Counts and Estimate

Because sage-grouse exhibit fidelity to lekking and nesting sites (Fischer et al. 1993), lek counts are widely used to estimate the local population size (Connelly et al. 2004). The historic (pre-settlement) size of the group of sage-grouse that breed in the Alton area is not known, but is believed to have never been large (Frey 2009). Anecdotal documentation from lifetime residents of Alton suggests that sage-grouse populations near the town have fluctuated over time and always persisted over the last 100 years, but never reached high numbers as seen in other parts of the analysis area (Frey 2008).

Lek count data since 1955 indicate fluctuations in male grouse attendance at the traditional Alton–Sink Valley lek, with declines in lek attendance in 2002 and 2003 (presumably in response to extreme drought in the region), an upturn in lek attendance in 2005, and occasional years without any lek activity(Frey et al. 2008). Lek attendance at the Alton–Sink Valley lek complex declined from approximately 20 males in 1984 to 12 males in 2013 (Frey et al. 2008). Lek attendance at the Alton–Sink Valley complex was in decline before mining began on Coal Hollow in 2010. It is generally thought that abundance of the group that breeds in Alton–Sink Valley has been in decline due to increasing habitat loss and reduced connectivity to other breeding groups—impacts ultimately from the conifer encroachment described above.

Table 3.18.4 lists the maximum male attendance counts for the Alton–Sink Valley lek complex according to counts done by the UDWR (all lek locations within the complex combined). No males were observed displaying breeding behavior in 2011, but males were observed in subsequent years. The reason for this documented absence may be because an extremely harsh winter made observer access to the lek location impossible until later in the breeding season (Schaible 2013b). It is possible the breeding displays had taken place before the lek location could be surveyed. Additionally, it is possible that the breeding displays had taken place at other locations in the complex, but the deep snow made it difficult to search for other active lek locations (Schaible 2013b). It is unknown whether this periodic documented absence represents an actual lapse in breeding behavior in response to the heavy winter, or is a result of survey timing. The observed increase in breeding activity in 2013 may have been in response to a mild winter (Schaible 2013b).

Table 3.18.4. Alton–Sink Valley Lek Complex Counts 2004–2013

Year	Maximum Males in Attendance
2004	5
2005	12
2006	13
2007	4
2008	3
2009	2
2010	1
2011	0*
2012	4*
2013	12*

Source: Personal communication, Schaible (2013).

* Indicates years where active mining was occurring at the Coal Hollow Mine adjacent to the tract during the breeding season. See Map 1.2.

The total amount of birds breeding in the area is estimated at approximately three times the annual male lek count. Lek counts have resulted in an estimate of 30–39 birds inhabiting Sink Valley, ranging over the years sampled from 0 to 39. However, UDWR cautions against placing an exact estimate on such a small part of the population, because actual connectivity with other areas is still not well understood (Schaible 2013b).

3.18.3.5.3 Tract and Transportation Route Habitat

Frey et al. (2013a) documented sage-grouse habitat preferences using radio telemetry in the Alton area from 2005 to 2009. The observed habitat use was unique in that grouse used agricultural habitats almost as much as sagebrush habitats. Also, the Alton grouse often used pinyon-juniper habitat, a behavior that is atypical when compared to other populations throughout its distribution. This unusual use of habitat may indicate 1) these grouse have adapted to habitats atypical for other grouse because they occur on the fringe of the distribution; or 2) the grouse are responding to a lack of suitable habitat in the area by occupying atypical habitat types. In support of the second theory, Connelly and Doughty (1989) report similar use of agricultural areas, and suggest that this use was indicative of a lack of available forbs in the brood-rearing season, as cited in Frey et al. (Frey et al. 2013a). Frey et al. (2013a) also suggest that the use of pinyon-juniper habitat may be because the birds are searching for shade in summer and cover in winter in response to a lack of sagebrush canopy cover. The documented use of completed vegetation treatments by grouse (as described in Section 3.18.3.4.2) further supports this theory.

Table 3.18.5 displays the seasonal habitat types designated by the UDWR, as well as high-use vegetation cover types present in the tract and transportation route (as described in the Vegetation section). Note that these acres overlap and do not sum to the total tract acreage. For context, Table 3.18.5 also presents the percentage of the analysis area these habitat types represent.

Table 3.18.5. Greater Sage-Grouse Habitat in the Tract and Transportation Route

	Tract (Acres/% of Tract)	Amount of Habitat in Analysis Area (total acres/% of analysis area represented by tract)	Transportation Route (linear miles/% of route)*
UDWR Habitat			
Occupied†	3,550.8/99%	271,617.1/1.3%	–
Brood-rearing	–	–	37.9/34.5%
Winter	–	–	2.8/2.6%
Vegetation Cover Types			
Sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush,	1,620/45%	244,180/0.6%	–
Annual and perennial grasses and meadow (wetland, including agriculture)	387/11%	20,482/1.9%	–
Shrub-steppe	–	–	3.5/3.2%

Source: UDWR (2011).

* Includes habitat in the Panguitch and Bald Hills SGMAs.

† The tract habitat is designated by UDWR as brood-rearing habitat, but based on site-specific information available to date (i.e., Frey et al. 2013; Frey 2010; (Curtis et al. 2007); the Petersen reports in Appendix 3-5 of the Coal Hollow permit application package (ACD 2007-2008), it is evident the species does not use the tract habitat solely for brood rearing; therefore, throughout this document, the term *occupied* is employed.

The radiotelemetry study described above concluded that the birds using the Alton–Sink Valley area are not migratory. Throughout all seasons (breeding, summer, late summer/fall, winter), grouse individuals made movements between the habitats near the lek and the croplands near the town of Alton, although use of the agricultural habitat declined over time with the increase in available sagebrush habitat from the vegetation treatments described above. In all, the sage-grouse observed in the Alton–Sink Valley were found to have an average year-round home range size of approximately 5,026 ± 378 acres (Frey et al. 2013b). This home range size estimate includes 90% of the documented locations of grouse observations. The average home range size for the year-round core activity, including 50% of documented locations, was 1,391 ± 94 acres (Frey et al. 2013b). This "average" home range includes most of the tract, and extends beyond the tract to the northwest and southeast. Map 3.26 displays the 90% and 50% average home range for the breeding and brood-rearing seasons, respectively, as well as the 95% home range for both the late brood-rearing and winter seasons.

The tract is not formally recognized by UDWR as wintering habitat; although, it is evident that it supports wintering individuals. Because the tract is at the fringe of the sage-grouse distribution, the wintering habitat may be suboptimal when compared to habitat in the core of the species distribution.

3.18.3.5.3.1 Breeding, Nesting, and Brood-rearing Habitat in the Tract

The UDWR identified 3,550.8 acres of the tract (99% of the tract and 1.3% of the analysis area) as occupied habitat (see Map 3.25 and Table 3.18.5). Breeding and nesting habitats (February–April) include sagebrush/grassland and sagebrush/grassland (treated) habitats in the southeast portion of the tract (Block S). Because only four of the 31 radio-collared birds were female, the small sample size prevents any definitive determinations on the true extent of nesting habitat. However, based on the telemetry information, some sage-grouse nest in sagebrush habitats adjacent to the Alton–Sink Valley traditional lek (Curtis et al. 2007). During the nesting season, male individuals were also documented using the agricultural habitats of Block NW. See Map 3.26 for the 90% and 50% average breeding season home range calculated from 2005 to 2009 (Frey et al. 2013b). These areas encompass 5,589 and 1,305 acres, respectively, for a total of 6,894 acres of documented breeding habitat.

Summer brood-rearing habitats (early: May–July; late: August–October) include sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses in the south portion of the tract, and grassland, meadow, and agricultural habitats in the north portion of the tract. During summer brood-rearing season, approximately 1/3 of nesting females moved their chicks from nesting habitats to horse pastures and wetlands north of the tract (Curtis et al. 2007), and the remaining 2/3 used Block S (Frey et al. 2013b). See Map 3.26 for the 90% and 50% average early brood-rearing season home range and the 95% average late brood-rearing season home range (Frey et al. 2013b). According to the telemetry data (Frey et al. 2013), the 90% and 50% early brood-rearing home range consist of 7,057 and 1,789 acres, respectively. The late brood-rearing home range consists of 3,647 acres.

3.18.3.5.3.2 Wintering Habitat in the Tract

As mentioned previously, though habitat in the tract is not identified as wintering habitat by UDWR (Table 3.18.5; State of Utah 2013), recent research has verified that birds are using the habitat in the tract for wintering, in addition to nesting and raising broods (Frey et al. 2013b). Map 3.26 displays the average winter home range size, accounting for 95% of documented locations, for birds that breed in the Alton–Sink Valley, consisting of 3,988 acres.

In addition to the local birds that remain in the area year-round, relatively large numbers of sage-grouse (60–70) visit Alton–Sink Valley in the winter (Frey 2009). The number of sage-grouse wintering in the Alton–Sink Valley area exceeds the estimated number of sage-grouse in the local area year-round. A small flock was documented moving from Hoyt’s Ranch to the Alton–Sink Valley area in the late summer (Frey 2010), indicating that some wintering birds may move to the area from northern breeding locations, such as Hoyt’s Ranch. Additionally, 56 sage-grouse were observed in the Ford’s Pasture area in January 2013 (Petersen 2013a), which indicates that birds may also move through Sink Valley while en route to more southerly wintering habitat.

3.18.3.5.3.3 Transportation Route Habitat

The Greater Sage-Grouse habitat intersected by the hauling route includes habitats occupied by the Panguitch population as well as the adjacent Bald Hills population. Approximately 38 miles, or 34.5%, of the hauling route intersects with brood-rearing habitat. An additional 2.8 miles, or 2.6%, of the route intersects with winter habitat.